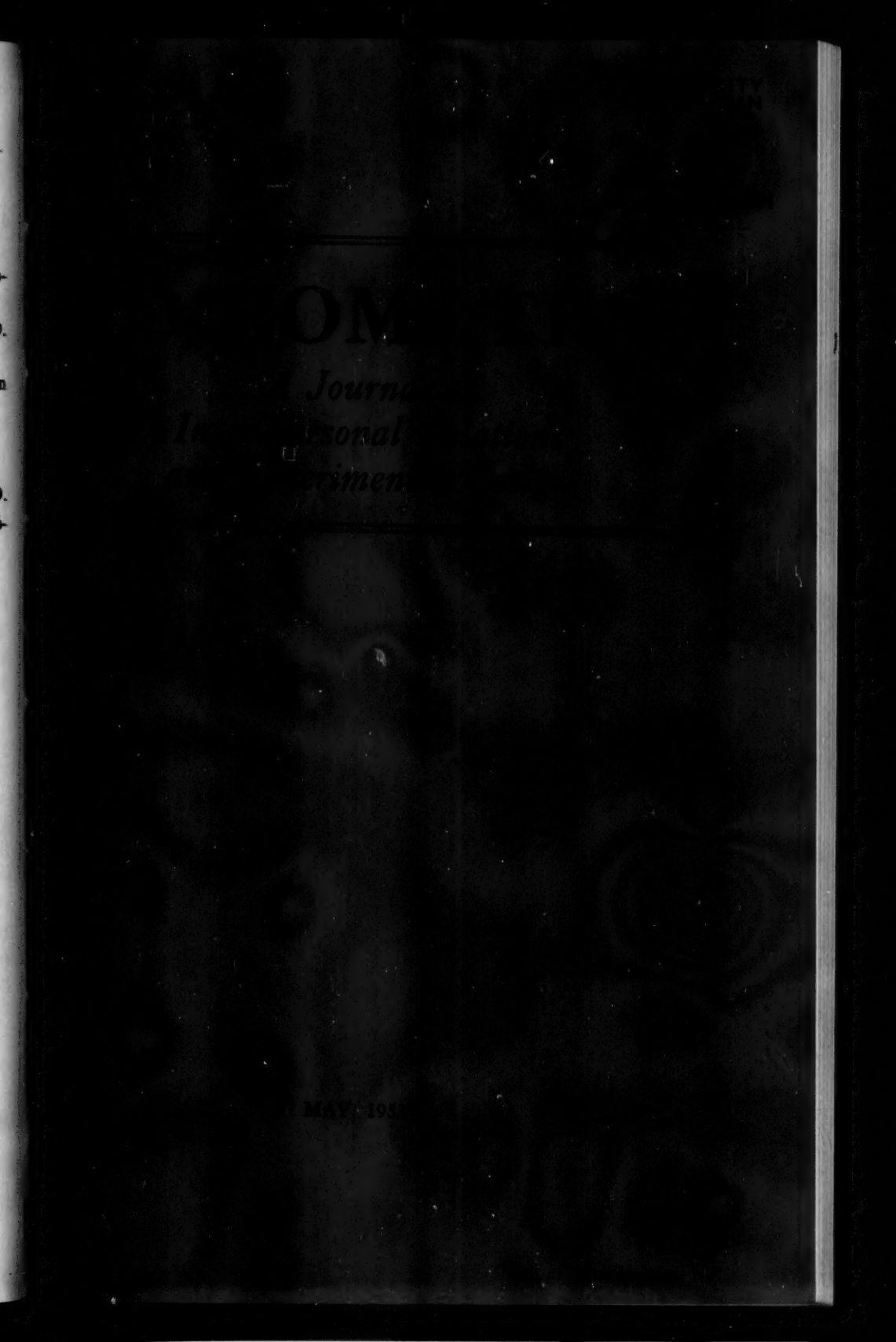

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Vol. XVI MAY, 1953 No. 2

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A Journal of Inter-Personal Relations and Experimental Design

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Membership dues in the American Sociometric Association: $7.00 including subscription to this journal.

Published quarterly by Beacon House, Inc., at Beacon, N. Y., in February, May, August and November. Address all communications to: Beacon House, Inc., Beacon, N. Y., or 101 Park Avenue, New York 17, N. Y. Re-entered as second class matter, October, 1943, at the Post Office at Beacon, New York, under the act of March 31, 1879.

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Vol. XVI MAY, 1953 No. 2

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THE SOCIOMETRIC STABILITY OF PERSONAL RELATIONS AMONG RETARDED CHILDREN[1]

HUGH MURRAY
Monyhull Hall, Birmingham 14, England

I. INTRODUCTION

The account given in the following pages is of an operational research, a limited investigation designed to provide an answer to a specific problem arising in a real-life situation. In a Residential Special School for educationally subnormal children who had failed to make a satisfactory social adjustment in Day Special Schools, the stage had been reached when it was possible to focus attention on the therapeutic possibilities of the out-of-school hours. The development was envisaged of therapeutically effective groups based not solely upon individual attributes such as life age, mental age, I.Q., or achievement level, but on the interpersonal phenomena which are generated by the interaction of individuals associating together. A club leader or therapist might, for example, select natural groupings of children of whose interpersonal relations he was aware, or build up groups possessing markedly different structures so that the members could gain experience of being in different social climates, or assign a child to a group of known structure for a specific therapeutic purpose. The need to organise more out-of-school social clubs and activity groups, to allocate new arrivals to suitable homes and to reassign difficult children to new homes, led to the recognition that an exact knowledge of the interpersonal relations among the children and of the social structure of the residential homes would be invaluable.

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[1] This chapter is adapted from a thesis entitled "An Investigation into the Stability of Personal Relations among Educationally Subnormal Children Living in an Institution", accepted in 1949 for the M.Sc. degree of Sheffield University.

Grateful acknowledgement is made to Dr. C. J. C. Earl, F.R.C.P.I., Medical Superintendent of Monyhull Hall and Monyhull Residential School, for permission to conduct and report the investigation.

EDITOR'S NOTE: A short section of this paper entitled "The validity of the data" has been omitted. Ten case presentations with social atoms have also been omitted. Concerning presentation of statistics the author states: "In order to simplify the presentation of results and to improve readability the following convention has been adopted: Any difference significant from 5% to 10% has been called 'almost significant,' any difference significant from 2% to 5% has been called 'significant,' and any difference at or below the 1% level has been called 'highly significant.'" EFB

It was realised that it would not be practicable, if indeed desirable, to ascertain the pattern of the interpersonal relations on every occasion that they might be of use. With the available staff a complete survey could at the most be carried out only once every three months. The question then arose, if the results were both valid and reliable at the time of testing, could they be used for practical purposes at any time during the subsequent three months? In other words, how stable are the personal relations over a three monthly period? If something is known about the kind and extent of the changes within the population then the results can be used with greater confidence. It was to obtain such information that the investigation was conducted.

II. The Choice of a Technique

Because of the pressure of work on the psychological staff it was important that the technique for ascertaining the state of the interpersonal relations should be economical in time and require no elaborate experimental set-up or organization. Any technique involving reading or writing or whose instructions are other than very simple and clear is unsuitable for use with educationally subnormal or retarded children. The sociometric methods developed by Moreno appeared to be the most suitable for the purpose of the investigation and the development programme in general.

The paucity of published work relating to the use of sociometric methods among mentally defective and educationally subnormal persons is characteristic of the social lag in applying novel methods in a well established field of work. In 1933 Moreno addressed the American Association on Mental Deficiency on his early investigations and the paper was published in the proceedings of the Association (1). His work does not appear to have been widely followed up in the mental deficiency field and in 1942 a published list of the range of sociometric researches mentions but two. In 1935 Kephart (2 & 3) using sociometric tests with groups of high-grade feebleminded children in an institution found that satisfactory results from self governing groups were dependent upon the creation of closely knit social structures of high homogeneity. He used a knowledge of the social structure of the group to create changes in its atmosphere and found that certain difficulties of an antisocial or self-centered character which had proven resistant to individual treatment, disappeared quickly and naturally and that individual treatment became more effective. The number of publications concerning sociometric testing in elementary schools

make it probable that other work has been done with retarded children. For example, Shoobs (4) describes briefly a programme used with children of I.Q.s 71 to 100 which makes use of psychodrama, a therapeutic technique which grew out of Moreno's early work and which makes it likely that sociometric tests had been given. Sarbin (5) describes the use of similar methods in a mental deficiency institution and shows that young adult morons can be stimulated to react intelligently to social situations.

Moreno (6) conducted sociometric tests on mentally retarded classes in a Brooklyn school. He found that the organization of groups in which mentally retarded children prevail resembles the organization produced by children of pre-school ages and the early grades of the elementary school. The groups were found to show numerous unreciprocated choices, a low number of mutual choice pairs and many unchosen children. Such groups showed a diffuse and inconstant structure and were less differentiated than normal groups of the same life age. Reporting the concomitant testing of two criteria, Moreno states that mentally retarded individuals differentiate less between such choices than do normal children. The same children are chosen more often for both criteria than is the case for normal children: "This attachment to the same person for all social needs may have psychologically an economic advantage. Overlapping of the two functions in one group may be less demanding than their specialization into two groups for performance. . . ." Such findings however may be due not to an innate inability to differentiate roles appropriately, but to some feature of the total situation at the time of testing.

Jennings (7, 8, 9) examining the results of concomitant testing with several criteria found a difference in choice expression between what she called sociogroups and psychegroups. Sociogroups are groups whose social structure is based on a criterion which is common to all members; in psychegroups the structure is based on a strictly private criterion which is totally personal in nature and concerns no situation which is common to all members. The differences in choice expression on a psychetele and a sociotele basis apply only when both psychegroup and sociogroup affiliations are open to the individual and only when they are concomitantly tested. When only one criterion is tested, individuals are obliged to use it for all associations they wish to achieve, whatever the criterion. Where there is little opportunity for psychegroup life or less than the individual needs, psychegroup structures are carried into sociogroup life, or in extreme cases sociogroup life is used for forming psychegroup structures. It would appear that

Moreno's experience that mentally retarded children do not differentiate to the same extent as normal children on concomitant sociogroup criteria, may possibly be explained by the operation of a psychetele choice process: regimentation is not unusual in retarded classes in elementary schools.

In view of the demonstrated importance of the psychegroup structures for the individual and for the community as a whole, it was decided to use an appropriate psychetele basis for choices in the investigation. The psychological atmosphere and the organization of the school as a whole were taken into account in formulating the criterion question "Who are your best friends in Monyhull, that is, the people you like to go around with most of all?" The principal consideration was that though on the whole there was every opportunity for children to associate freely with their personal friends—particularly those in their own home—persistent difficulties of staffing and accommodation rendered necessary the unwelcome continuation of some regimentational control of the children by the nursing staff. The children rarely had the opportunity of freely collaborating with one another in work situations common to all of them as opposed to situations which are essentially personal in nature, such as free play. Psychegroup affiliations are therefore most likely to be dominant in all activities.

Sociometric studies on friendships (17, 18, 19) conducted prior to Jennings work on sociogroups and psychegroups are of little relevance to our problem because of different implications in the criteria used, the wide cultural differences between the United States and the United Kingdom, and the primary concern in these studies with isolated and rejected children in the middle ranges who are not intellectually retarded. Furthermore the investigations were carried out in "open" communities such as day schools as opposed to "closed" communities like residential schools whose population is cut off from outside contacts. With unselected populations under such conditions, factors such as I.Q., mental age, life age, academic achievement and socioeconomic background are found to be limiting rather than definitive in determining friendship. In a highly selected homogeneous population such as in a residential special school, it is not to be expected that such factors will be of importance in distinguishing between the chosen and unchosen, at any rate when such factors are assessed by standard objective tests. Whether or not they are of importance if they are assessed by the individual making the choice in a test is a matter for further enquiry with which this investigation is not concerned. It may well be that how a person appears to stand in relation to the person choosing him is a much

more important factor in determining friendship than how he actually does rate on some objective frame of reference which is meaningless to the chooser.

The study of the temporal development of interpersonal relations has on the whole lagged behind studies which deal with the spatial facts of interpersonal relationships. With the exception of Moreno (21) and Jennings work (9, 10, 11, 12) little attention has been paid to the study of the same group over a period of time. These studies and those of Kerstetter (13) and Cook (14) have been focussed mainly on changes in individual choice status as measured by the number and quality of choices received. Jennings has shown that the individual has a characteristic range of choice and rejection of others and that he does not significantly depart from this whatever the extent of others choice or rejection of him. The individual is also the focus of a significantly consistent amount of choice and rejection. The total group structure tends to retain its characteristics from one time to another in spite of the fact that shifts are bound to occur, since interaction cannot be static.

There has been relatively little study of the stability or persistence of either the individuals choice of others or of others choice of the individual. Moreno (6) considered the possibility that the opinions, particularly of adolescents, might fluctuate rapidly. Given a period of 90 days in which they were allowed to change their choices, he found that a group of girls "maintained their original choices and responses to the extent of 95 per cent". Kerstetter (15) also investigated the persistence of choice among children in class groups. Jennings (12) gave a series of 17 sociometric tests at two monthly intervals to a group of girls in an institution as part of an investigation into the structure of leadership. In it she reported the stability of the social atom by means of a single ratio which represented the percentage of persons who repeatedly chose the individual. No one, it appears, has investigated both the stability of the individual's behavior towards others and the behavior of others towards the subject, that is, to what extent the individual chooses and is chosen by the same people on successive tests.

The foregoing brief review of the literature makes it clear that before we can proceed to explore the stability of the interpersonal relations of the retarded group in question, we must first ascertain whether this group of retarded children behaves on sociometric tests in much the same way as groups of normal children. Evidence will be needed that the results are valid indi-

cators of the state of interpersonal relations; that certain phenomena resulting from the operation of the tele factor said to be characteristic of most naturally occurring human groups, are present. The manner and consistency of the response of the group as a whole to the test situations requires examination in order to determine which parts of the data are most appropriate and valid for the purpose of the investigation.

Against this background the manner of operation of the choice process as reflected in individual differences in choice behavior will be examined; first taking each aspect of choice behavior singly to ascertain the consistency of the behavior of the group as whole, then together to pattern the individual's choice behavior relative to the group. The persistence of choice behavior will then be examined both in its quantitative aspects and in terms of the relationships between persons, which will lead to a consideration of the stability of individual choice behavior and some behavioral correlates of the different patterns of stability within the social atom.

III. The Procedure Used in the Investigation

The investigation was limited to the children living in one of the boys homes—B4—since the main developmental programme was likely to start there. Most value it was considered would in the long run accrue from surveying the home containing the youngest and least mature children. They would, of all the children present, be spending the longest time in the institution and would in due course be most affected by the new developments. Furthermore, it was suggested by some experienced staff that in the youngest children's home the least stable personal relations were thought to exist. A knowledge of the least stable group would give some idea of the extreme of instability to be expected, though the information would not of necessity be directly applicable to groups of older and more mature children in the institution.

Each child was seen individually by the investigator during the late afternoon in the home in which he lived. During the course of an informal conversation about his activities and interests he was asked "Who are your best friends in Monyhull, that is, the people you like to go around with most of all?" The names each child gave were recorded in the order used by the child. The child was free to give as few or as many names as he wished and no restriction was placed on who could be included, except that they must be connected with Monyhull in some capacity.

The test was administered on three occasions, twelve weeks apart, the actual dates in 1948 being April 1, June 23, Sept. 12. This was to enable two sets of comparisons to be made, first between April and June when the intervening period was largely uninterrupted school attendance, and between June and September when the period included the summer holidays, during which two thirds of the children were away from the institution for about a month. We are thus in a position to compare the stability of the interpersonal relations under conditions when the children have been together for three months or more and when they have been separated for a time by holidays. These two sets of conditions are the possible extremes of unity and disunity of the population. All the occupants of the home B4 at the time of the three tests and all the children in the other boys' homes—B3, B2, B1,—who were chosen by them, were tested on the first occasion on which they were chosen and on succeeding tests whether they were chosen or not.

Because the investigator was known to the children from previous visits and interviews rapport was quickly established. Prior knowledge of each child enabled the general talk to be developed in such a way that the question could generally be asked in a context that gave it emotional significance for him. The question was elaborated when necessary to ensure that the child understood it: this being necessary for the duller and younger children. It was evident to the investigator that the situation presented no difficulty for the children when handled in this way. In phrasing the question, the word "Monyhull" was used in preference to "School" with the intention of focussing the attention of the child on his total life situation rather than the limited aspect which is implicit in the word "school." For this reason also the testing was carried out in the home after school hours when free association was possible in the grounds. Unlimited expression was allowed in order that the whole range of the children's friendship desires could be explored and the consistency of the individual's expansiveness determined by further testing. Freedom to include, for example, boys, girls, medical, nursing, domestic and administrative staff was essential, so that the aspect of interpersonal relations under consideration—those among the children—could be viewed in its true context.

During the course of the investigation the information collected was available to and was used by the staff in their daily work. Where such information indicated a certain line of action, this was taken irrespective of whether it might complicate the evaluation of the results, for not to do

so would be a negation of primary responsibility for one's "patients" and would further create a situation that would not in ordinary and future practice occur. The investigator was guided by the maxim that there should be no research without therapy and conversely, no therapy without research.

IV. The Characteristics of the Population

Home B4 in which the investigation was centered had a constantly and slowly changing composition during the time of the investigation, no more than four new children entering the home in the twelve weeks preceding each test. Any differences between the results of the three tests are unlikely to be due to gross changes in the composition of the home at any one time. Of the 44 children present for all tests, one has been excluded from the results because he was subject to major epileptic fits during the period of the testing. This child was unchosen by anyone on any of the three tests and his responses to the test were so abnormal as to render them unreliable. For certain purposes the total population (less the one excluded case) present in the home at the time of each test will be used, these being designated P1 ($N = 50$), P2 ($N = 50$), P3 ($N = 51$); for other purposes the population present for all three tests, Pc. ($N = 43$) will be used.

At the time of admission 35 per cent of group Pc. had appeared before juvenile courts for indictable offences; 15 per cent were illegitimate and 26 per cent had been brought up or spent some time in pauper or similar institutions; 35 per cent came from broken or otherwise unhappy families. In 33 per cent of the cases one or both parents were reputed to be either defective, epileptic or have been in a mental hospital.

The average length of residence at the time of the first test was 19 months, three quarters of the group being resident for less than two years. The average age for the group then was 11-3, the average mental age 7-9 and the average I.Q. 70. The older children in the home have of course been in residence longer and they have on the whole lower I.Q.s than the younger children, for the brighter older children being psychobiologically more mature are transferred more quickly to other homes than are the duller children of the same age.

Thirty-seven per cent of the children studied did not go away for the customary one month summer holiday, either because it was not possible or advisable to arrange it. Those not having a holiday were found to be duller and more badly behaved than the others; they are therefore thrown more closely together as a group between the second and third tests. Because

of the classification system in the school, as opposed to that in the homes, children of similar age, I.Q. and achievement level are thrown more closely together and in school classes they also meet children of similar endowment from other homes. At school too, they can maintain contact with children who have progressed from home B4 to other homes. Such organisational features which directly influence the formation of sociogroup structures are likely under the prevailing conditions also to influence psychegroup affiliations.

V. The Response to the Tests

As we are primarily concerned with the stability of the personal relations among the children in B4 over two consecutive periods, our attention is directed to the 43 children comprising group Pc, who were present in the home for all three tests. The problem is now to enquire whether this group responds to the tests in a consistent manner. The children were allowed to make an unrestricted number of choices within the area "Monyhull"; Table I shows the number of children who made choices in each of the three major areas and their constituent sub-areas shown below.

Area H: Home B4.

Area O: Other homes—B3, B2, B1.

Area S: Staff—B4 nursing staff, Senior staff of doctors and matrons, School teaching staff, Administrative staff.

TABLE I

No. of Children Making Choices in Each Area

	H	B3	B2	B1	*O*	B4 staff	Senior staff	School staff	Admin. staff	S
Test 1	40	10	6	7	15	8	6	2	0	10
Test 2	37	13	6	6	17	15	2	1	2	16
Test 3	40	14	10	9	21	14	2	1	1	14

The lack of intersexual choice which is typical of children at the age levels in question (6) was complete but for the single exception of one boy who chose his sister on the first test. This choice has been excluded from all calculations. This almost complete absence of intersexual choice is however most unusual for it persists also in the higher age groups in the school and presumably reflects the sexual taboo common in institutions.

With the exception of three children on the first and third tests and six on the second, all children make choices in their own home, B4. The

drop in the number of children making choices in B4 on the second test is due to four boys who restricted their choices on this test only, to outside homes. They were all long residents and it is highly probable that they did so in an attempt to get themselves transferred to other homes, *a behavior which does not, of course, invalidate the testing;* 38 children react the same way (i.e. either do or do not make choices in B4) on Test 2 as on Test 1, 36 react on Test 3 as on Test 2. The behavior in making choices in B4 is therefore highly consistent from test to test.

With regard to choosing children in homes other than B4, it was found that 35 children reacted the same way on Test 2 as on Test 1 and 33 reacted on Test 3 as on Test 2, the respective tetrachoric correlation coefficients being .82 and .79, both of which are highly significant. The proportion of children making choices in the three homes B3, B2 and B1 is also found to be fairly constant, on an average 67 per cent of the children making outside choices choose children in B3 and 39 per cent in each of B2 and B1. These results indicate that the group behaves consistently from test to test with respect to choosing children in other homes. Chance expectancy would, however, lead us to expect that half the group would make choices outside; on Test 1 the number behaving so is significantly less than chance, yet not significantly so on the second and third tests. The fact that about half of the children consistently made outside choices on each test lends support to the view that such behavior reflects the real situation in the group and is not a chance matter. On the other hand it may well be construed as evidence for the stability of behavioral stereotypes which were originally chance determined. The former view would be sustained if systematic differences between children making outside choices and those not making outside choices could be demonstrated, but as this aspect is not immediately relevant to the investigation, it has not been pursued.

The number of children choosing staff is significantly less than chance, the number doing so on the first test being rather less than on the later tests. On the first test also a greater proportion chose senior staff which seems to indicate some anxiety in the novel test situation. This cautious behavior leads us to assume that acceptance of the initial test situation was by no means complete, at any rate with regard to staff relationships. Nevertheless, 27 children react the same way (i.e. either do or do not choose staff) on Test 2 as on Test 1 and 33 react on Test 3 as on Test 2, figures which are of the same order of magnitude as those given for outside choices. There is evidence therefore that once this test procedure is accepted by the chil-

dren, apparently as a result of experiencing it, they behave consistently in making or not making staff choices.

In Table II is given the frequency of occurrence of the possible individual patterns of choice location in the three main areas H, O and S. On only one occasion did a child make no choice at all. This child had been in residence for three months and during this time his behavior was suspiciously pre-psychotic. When tested he said "They won't be my friends, I give them things, but they won't be my friends." (Since then he has made considerable improvement and appears to have settled down quite satisfactorily.)

TABLE II

No. of Children Using Various Patterns of Choice Location

	None	H	O	S	HO	HS	OS	HOS
Test 1	1	18	1	1	13	8	—	1
Test 2	—	15	5	1	7	10	—	5
Test 3	—	13	2	1	14	8	—	5

The distribution for Test 1 shows clearly the restricted approach to the staff which has resulted in fewer HOS patterns than in the second and third tests. It has already been noted that four children having HO patterns on Tests 1 and 3 had pattern O on Test 2; if allowance is made for this the distribution for Tests 2 and 3 are very similar. The smallness of the number choosing both outside children and staff on Test 1 precludes the reliable computation of tetrachoric r between these variables, but an estimated value of —.65 is not seriously in error. Neither of the correlations for Tests 2 and 3 are significant, the values being —.20 and —.40 respectively. On the first test children who make choices in addition to those in home B4, tend to choose either staff or children in other homes, but rarely both. This phenomenon is much less marked on the second and third tests.

Seventeen children have identical patterns on Tests 1 and 2 and 21 on Tests 2 and 3. In addition 14 children continue to make choices on Test 2 in the areas used on Test 1 and 11 children continue to make choices on Test 3 in the areas used on Test 2. That is, approximately three quarters of the children continue to make choices in all the areas used in the previous test. There are only three instances of complete change of pattern. The child previously mentioned as making no choices on Test 1 had pattern HO on Test 2; the youngest and least intelligent child had pattern H on

Test 2 and pattern S on Test 3; another H pattern on Test 2 changed to O on Test 3—one of the younger, more intelligent children but the most aggressive and difficult child in the home.

The foregoing analyses have been concerned simply with whether or not the children consistently made choices in each of the defined areas, without considering the amount of choice used. Table III gives, to the nearest whole number, the percentage distribution of choices to each area and its constituent parts.

TABLE III

PERCENTAGE DISTRIBUTION OF CHOICES TO EACH AREA

	H	B3	B2	B1	*O*	B4 staff	Senior staff	School staff	Admin. staff	*S*	Total choices
Test 1	61	11	4	7	22	11	5	1	—	17	190
Test 2	57	8	3	4	15	25	1	1	1	28	242
Test 3	57	9	5	5	19	21	1	1	1	24	257

The distribution for Test 1 differs in several respects from those for Tests 2 and 3 which resemble each other closely. Significantly fewer choices are made on Test 1 and these are more frequently given to children both inside and outside the home than to adults on the staff among whom a significantly greater proportion are given to senior staff. The ratio of choices given to staff intimately concerned with the home B4 against choices given to all other staff is about 2:1 on the first test, 10:1 on the second and 8:1 on the third test. This cautious reaction towards staff has already been noted but here the distortion of the choice behavior is clearly underlined. If we follow Moreno (6) and Jennings (9) and define the extent to which an individual chooses others as a measure of his emotional expansiveness, we may conclude that for the group as a whole its emotional expansiveness is constant over a three monthly period in areas where, or at times when, there appears to be no cause for anxiety. Anxiety is reflected by lowered expansiveness and cautious choice usage. The emotional expansiveness of the group as a whole does not appear to be affected by changes in the occupation or location of the children between tests nor by dispersal of the group during holidays.

The reality basis of choices made to children outside the home may be judged by the extent to which such choices are reciprocated and the extent to which children in other homes choose children in home B4, for

we have ascertained the choices of all children in other homes chosen by the group. Detailed examination of the data shows that choices directed to children in the two senior homes practically all lack reality, for of 64 choices so made on three tests only 2 were reciprocated and only another two made in return. The situation with regard to home B3 is much different, for this is the home to which B4 children are ultimately transferred. Of the 63 choices made on the three tests to children in home B3, 14 were reciprocated and a further 22 were received from children in B3. Such inter-home choice occurs mainly between children who have known each other whilst in home B4 and then only during the period of relative insecurity following admission to the new home.

We may summarise that the emotional needs of the children in B4 are centered primarily in the home, on an average 57 per cent of their choices being to children in B4 and 24 per cent to staff connected directly with the home. Next in order are children who are closest in general maturity (B3) who receive 8 per cent of the choices. The children as a group are consistent and constant in their choice behavior over a three month period. Since we have shown that choices to children in homes B2 and B1 are on the whole unrealistic (though in a few isolated cases they are quite realistic), and since it is possible that outside choice behavior generally might have been originally determined by chance, in the following sections we shall be concerned only with the choices made by group Pc to children present in B4 at the time of each test, for this will provide the bulk of the information sought in the operational investigation.

VI. The Consistency of Choice Behavior

We now direct our attention to individual differences in choice behavior in order to ascertain whether the individual's emotional expansiveness towards others and others' emotional expansiveness towards him is characteristic or whether it is limitless and randomly variable. Table IV sets out for each of the tests the medians, means and standard deviations of the distributions of the number of children chosen by each child, the number choosing each child and the number reciprocating choices made by each child; critical ratios of the differences between means are given and product moment correlations with their significance.

The correlation between the number of persons chosen on Tests 1 and 2 (.45) and on Tests 2 and 3 (.62) are both significant and the differences between the correlated means of successive tests are in neither case sig-

TABLE IV

CHOICE BEHAVIOR OF THE 43 CHILDREN PRESENT FOR ALL TESTS

No. of Persons:	Chosen by subject			Choosing the subject			Reciprocating subject's choice		
	Test 1	Test 2	Test 3	Test 1	Test 2	Test 3	Test 1	Test 2	Test 3
Total Reactions	116	137	147	109	137	155	43	55	45
Median	2.15	3.00	3.25	2.33	2.85	2.89	0.82	1.06	0.87
Mean	2.70	3.19	3.42	2.53	3.19	3.60	1.00	1.28	1.05
S.D.	1.91	2.22	2.31	1.80	2.16	2.44	1.01	1.19	1.06
"t" (means)	1.47	0.25		1.85	1.19		1.47	1.18	
"r"	.45	.62		.33	.50		.37	.34	
"t"	4.09	5.12		2.22	3.69		2.53	2.33	

For 43 cases, in order for r to be significant at the .05 level of chance, "t" must equal or exceed 2.02, and at the .01 level it must equal or exceed 2.70.

nificant. Thus while the average performance of the group as a whole does not change significantly between tests given at three monthly intervals, individual children behave on successive tests in a way that is only moderately consistent. The child tends to retain in some degree his position relative to the group with regard to his emotional expansiveness. The relative magnitude of the two correlations suggests that any anxiety engendered by the first test is more disturbing to an individual's emotional expansiveness than absence from the group which may have occurred between the second and third tests. We may conclude that the child's capacity for and range of emotional expansiveness for others is not limitless nor subject to random variation, the number of persons a child chooses being moderately constant over a three monthly period and not being susceptible to environmental changes of the kind prevailing during the investigation.

The correlations between the number of persons choosing the child on Tests 1 and 2 (.33) and on Tests 2 and 3 (.50) are both significant, indicating that the individual child tends to elicit relatively the same amount of choice on successive tests and maintains to a moderate degree his position in the group with respect to the amount of choice he receives.

Thirty-seven per cent of the choices on Test 1, 40 per cent on Test 2 and 31 per cent on Test 3 are reciprocated, the only difference approaching significance being that between Tests 2 and 3. This relatively great decrease which is associated with the dispersal of the group during holidays leads us to believe that the maintenance of reciprocal relationships is dependent on the opportunities individuals have of coming into contact with one another. The number of children who on successive tests reciprocate the subjects choice correlates significantly in both cases, the values being .37 between Tests 1 and 2 and .34 between Tests 2 and 3. Thus the individual maintains his position relative to the group to a low degree with respect to the extent to which his choices are reciprocated.

The three aspects of inter-relations when considered singly are thus to a moderate degree consistent in their operation from test to test. Such information does not enable us to understand the structure of the constellation of each child's relationships. It is necessary to examine as one unit the emotional expansiveness of a child towards others, their expansiveness towards him and the extent of the mutual choice between the child and others. This may be conveniently done by relating the child's performance on each of the three aspects to the mean of the group for each of the tests. The direction of the deviation may be shown by + or — and the aspects given in the following order:— number chosen by subject, number choosing subject and number reciprocating subject's choices. There are therefore eight possible choice patterns: + + +, — — —, + — +, — + —, + + —, — — +, + — —, — + +. The same four patterns — — —, + — —, — + — and + + + characterise the greater part of the population on each test, covering at least 80 per cent of the children though the actual incidence of occurrence of the patterns varies from test to test because of the differences in the proportions falling above and below the means and in the correlation between aspects.

On the second test 13 children have the same pattern as on the first test, while on the third test 16 have the same pattern as on the second test. The majority of children therefore show changed patterns, though a certain proportion of changes are bound to occur for children who rate near the mean on any aspect. *Children who show the more frequently occurring patterns are more likely to retain their pattern on retesting three months later than are those with less frequently occurring patterns. Three of the* four least frequently occurring patterns are shown by different individuals on each test, while the fourth (— + +) is shown by the same child on the

first and second tests only. In only one case does an individual move from one of these four patterns to another, from + — + on Test 2 to + + — on Test 3. Hence these four patterns must be regarded as reflecting transitory stages in inter-relations. About the same proportion of children maintain the — — — pattern over the two periods, 58 per cent and 53 per cent respectively; 50 per cent retain the + — — pattern over the first period but only 20 per cent over the second, which suggests that some relatively under-chosen and under-reciprocated children tend to "withdraw" when in prolonged contact with the group but revert to an above average expansiveness for others when they have for a time been freed from contact with the group as whole. We may conclude that certain patterns occur more often than others and that they are likely to be retained to differing degrees.

When considered in terms of the group mean the constellation of relationships has been shown to be patterned in various ways which enables individual differences and similarities to be revealed. Further information about the consistency of the behavior of the individual can be gained by examining his interpersonal relationships in terms of the balance between the number of choices he makes, the number he receives and the number of choices that are reciprocated. Two ratios may be used to describe the internal structure of the social atom: the "Interchoice Ratio of Balance" which is the ratio between the numbers choosing and chosen by the subject and the "Reciprocation Ratio" which is between the numbers reciprocating and chosen by the subject.

The mean interchoice ratio for the group which falls close to 1.5 does not differ significantly between tests; the correlation between Tests 1 and 2 is .40 and between Tests 2 and 3, .46, both being highly significant. The mean Reciprocation Ratios which are close to .5, do not differ significantly from each other despite the lowered reciprocity occurring on the third test. The correlation between the first and second tests with respect to individual Reciprocation Ratios is 0.18, a value which is not significant; between the second and third tests the correlation is significant at 0.42. The lack of correlation in the first period is due to the lower emotional expansiveness of children on the first test which elicited only essential choices; e.g. a change from a single essential reciprocated choice on Test 1 to two choices on Test 2 would lower the Reciprocation Ratio from 1.00 to .50. The cumulative effect of changes of this kind was sufficient to lower the correlation to non-significance and we are therefore of the opinion that under normal

routing testing conditions the Reciprocation Ratio would be significantly related on successive tests. The internal structure of the individual's constellation of relationships retains a significant but moderate consistency and does not vary in a random and limitless manner.

VII. The Persistence of Relationships Between Individuals

From the point of view of the practical application of sociometric test results, the type of analysis given in the preceding section limits us to the utilisation of certain quantitative aspects of choice behavior. We can, for example, identify the over-chosen and the under-chosen members in the group or those with certain patterns in their constellation of relationships. But though an individual may be fairly consistent in the extent to which he chooses others or is chosen by them for example, it is conceivable that

TABLES V(a) AND V(b)
Comparison of the Choice Behavior of the Group as a Whole on Successive Tests

Behavior on Test 2	*Behavior on Test 1*			
	Choice not made	Unrecipr. choices	Reciproc. choices	All choices
Ch. not made	—	62	24	48
Ditto but choice received	—	10	18	13
Unrecip. choice	68	18	18	18
Recip. choice	32	10	40	21
Total per cent	100	100	100	100
Actual frequency	83	61	38	99

Behavior on Test 3	*Behavior on Test 2*			
	Choice not made	Unrecipr. choices	Reciproc. choices	All choices
Ch. not made	—	61	38	52
Ditto but choice received	—	4	16	9
Unrecip. choice	78	27	16	22
Recip. choice	22	8	30	17
Total per cent	100	100	100	100
Actual frequency	87	74	50	124

the individuals whom he chooses or who choose him, may be entirely different from one test to the next. For some purposes we want to know how stable are the person to person relationships.

In Tables Va and Vb the choices made at the beginning of the periods (Tests 1 and 2) are analysed in terms of the behavior between the same individuals at the end of the periods (Tests 2 and 3). The tables also include the behavior towards individuals chosen at the end of the period who were unchosen at the beginning, all percentages being given to the nearest whole number for the sake of clarity.

On Test 1 the 43 children directed 99 choices to children who were present in home B4 for both Tests 1 and 2. Of these choices 39 per cent were directed to the same children on Test 2. Of the 124 choices made on Test 2, 39 per cent were directed to the same children on Test 3. There is therefore no significant difference between the two periods with regard to the proportion of choices that are given to the same children on consecutive tests, the groups as a whole showing a significant tendency to change the individuals whom they choose on successive tests. The number of new choices made is approximately the same in both periods (83 and 87) but the proportion of such new choices that are reciprocated is lower in the second period as might be expected, 22 per cent against 32 per cent, though not significantly so.

Of the unreciprocated choices at the beginning of the periods about the same percentage (62 and 61 per cent) are not repeated and have not resulted in any choice by the recipients towards the makers of the choices. In the first period, however, 10 per cent of the unreciprocated choices at the beginning are not repeated but the recipients return the choice at the end of the period. In the second period the percentage of such cases falls to 4. There is also a slight drop, from 10 per cent to 8 per cent in the proportion of unreciprocated choices that became reciprocated by the end of the period. The percentage of unreciprocated choices that are repeated without producing reciprocation increases from 18 per cent in the first period to 27 per cent in the second.

Of 38 reciprocated choices on the first test, 40 per cent are reciprocated by the same individuals on the second test. Of 50 reciprocated choices on the second test, 30 per cent are reciprocated by the same individuals on the third test. Though there is an increase in the second period in the number of reciprocated choices that are mutually broken, 24 per cent to 38 per cent, the difference is not significant; 36 per cent of reciprocated choices are

broken by one member in the first period and 32 per cent in the second, a non-significant difference.

The effect then of scattering the group during the second period has been to lower the probability of reciprocal choice developing and to increase the likelihood of mutual disruption of already existing reciprocal relationships. In general if we are concerned to select compatible associates for a child up to three months after a test, the selection is best made from his reciprocated choices, though the chances are even that the child will be no longer "interested" in the other. If unreciprocated choice data is used the chances are two to one against him still being interested.

The analysis of individual persistent choice behavior has been conducted in much the same manner as in Section VII, the basic data being given in Table VI.

TABLE VI

PERSISTENT CHOICE BEHAVIOR OF THE 43 CHILDREN PRESENT FOR ALL TESTS

No. of Persons:	Persistently chosen by subject on		Persistently choosing subject on		Persistently reciprocating subject's choice	
	Tests 1 & 2	Tests 2 & 3	Tests 1 & 2	Tests 2 & 3	Tests 1 & 2	Tests 2 & 3
Total Reactions	39	49	38	48	15	15
Median	1.18	1.54	1.19	1.47	0.72	0.72
Mean	0.91	1.14	0.88	1.12	0.35	0.35
S.D.	1.03	1.05	0.97	1.04	—	—
"t" (means)	1.48		1.58		—	
r	0.51		0.54		0.80(a)	
"t"	3.77		4.12		—	

(a) Because of the nature of the distribution, r phi has been calculated on a two-fold table; chi squared = 16.22, P = .01.

Though there is an increase in the mean number of persistent choices in the second period, the difference is not statistically significant, nor is there any difference between the periods in the mean number of persistently reciprocated choices. On an average, children make one persistent choice and receive one. Between Period 1 and Period 2, the number of persistent choices made by the individuals correlates significantly at .51; for persistent choices received the correlation is .54 and for persistently reciprocated

choices the correlation given by r phi is .80. Thus the child retains to a moderate degree his position relative to other children in respect to the extent to which he is persistent in his choice of others and in the extent to which others persistently choose him. There is a high degree of consistency in respect to whether or not he has some of his choices persistently reciprocated. Generally speaking, persistence of choice behavior by and towards the individual is similar to the total choice behavior displayed, though it is more consistent on the whole particularly with respect to making or not making persistent choices, in maintaining or not maintaining mutual relationships and in being or not being persistently chosen. With regard to the extent to which this persistent behavior occurs, he is somewhat less consistent.

From the point of view of practical therapy, *whether or not* a child is capable of persistent choice or able to maintain a mutual relationship or become the focus of persistent choice is of relatively greater importance than the *extent* to which he is capable of achieving such relationships.

The individual's pattern of persistent relationship behavior may be readily visualized thus: for each of the three aspects—persistent choices made, persistent choices received and persistent mutual choice—the presence of one or more persistent choices may be shown by a + and complete absence by a 0. Five patterns are possible: + + +, + + 0, + 0 0, 0 + 0 and 0 0 0. Both periods show substantially the same frequency of occurrence of the patterns + + + (13 in both cases), + 0 0 (8 and 9), and 0 + 0 (10 and 9), but the second period has fewer 0 0 0 patterns (5 as against 10) and more + + 0 patterns (2 against 7) than the first. This follows from the increase in persistent choice in the second period. Twenty-three children have the same pattern in both periods, the most stable patterns being the two (+ + + and + + 0) which show persistent choice both by and towards the individual. From the individual point of view the + + + pattern is the most desirable and satisfying and is the one to which movement occurs. The + + 0 pattern appears to be typical for two children who exhibit it on both periods. The 0 0 0 pattern, which is a priori the least desirable and least satisfying to the individual, is also the least stable and the movement away from it is most marked. We may conclude that the individual may be characterised by the patterning of his persistent relations and that unless the pattern is one that shows some persistent choice both by and towards the individual, it has only moderate consistency.

VIII. The Stability of Individual Choice Behavior

While it is obvious that a child who persists in his choice of certain other children must show some stability in his choice behavior, children who achieve the same number of persistent relationships may do so by very different means. For example, one child with two persistent choices may have made only two choices on each test, while another with the same number of persistent choices may have made seven choices on one test and three on the later test, that is, the two children differ in the stability of their total choice behavior. For practical purposes it is important to know something about the variability between individuals with regard to the stability of choice behavior by and towards them and about the "variability of the individual's stability from time to time.

The stability index proposed by Hartshorne (16) may be used to describe the stability of individual choice behavior. The general formula for this index is:—

$$\text{Stability Index} = \frac{2R}{Go + Gl} \times 100$$

where Go is the size of the group at time o, Gl is the size of the same group (nominally) at time l, R is the number who survive the period of change. All children who have some persistent choice behavior have indices ranging from 1 to 100; children who have no persistent choices can have an index of 0 or 100 depending on whether any choices were made on either or both tests in question.

The obtained distributions showed that in both periods and for the three aspects of choice behavior for which Stability Indices were computed, there is a fundamental dichotomy in behavior distinguishing those who show some stability and those who show no stability in their choice behavior. Those children who show some stability in any period do so to differing degrees ranging in the main between indices 20 and 90. Complete stability in the choice of others is rare, though a number of children in the first period particularly, have an index of 100 indicating that their behavior is stable in that they make no choices on both occasions. Choice of the subject by exactly the same persons on successive tests is also exceptional. It is in relation to mutual choices that the highest stability indices are found, as we would expect from the previous examination of the persistence of choice behavior.

Though the distributions are scarcely suitable for the computation of product moment correlations, these have been done to ascertain whether the individual's stability indices are related on successive periods. This is found not to be the case for the first two aspects, the correlations of .04 and —.09 for "persons chosen" and "persons choosing" respectively not being statistically significant. The correlation of .60 between the stability indices for reciprocated choices is highly significant, showing that the individual maintains his position relative to the group as far as this index is concerned. The magnitude of this coefficient is however mainly due the result of the large number of cases in the extreme categories 0 and 100. Though the stability indices are not correlated on successive occasions, whether or not the individual shows some stability is seen to be fairly characteristic; the correlation given by r phi for "persons chosen" being almost significant at .32, for "persons choosing" it is significant at .41 and for "mutual choices" it is highly significant at .76.

The product moment correlations show that the stability index may be extremely and randomly variable for the group as a whole, but inspection of the scatter diagrams shows that for those individuals who show some stability on both periods and who make or receive choices on both periods, the absolute indices on successive periods are not widely divergent. The extreme differences which occur in the group and which lower the product moment correlations are in practically every case due to the individual not making or receiving any choices on one test in the period. There are three contributory causes: on the first test there was a general constriction in the amount of choice expended; on the second test a few individuals behaved atypically by not making any choices; the third cause is due to eliminating from this analysis those children who were not present for two consecutive tests, thereby increasing the number of children in the group who apparently made or received no choices. To this extent the analysis is artificial and in practice we would not use this approach which was intended simply to throw light on the general questions of the stability of person to person relationships.

In practice we want to be able to identify within the group those children whose choice of others is likely to change, and those whose choice by others is most unstable. Our evidence suggests that individuals may be distinguished by the stability of their interpersonal relations and that under more optimum test conditions the level of this stability may not be subject to widely random variations. At any time we would take into account all

previous test information that would provide evidence on this question and we therefore need a simple and quick method of collating such information. The following general formula which is adapted from Jennings (12) provides us with Stability Ratios in respect of persons chosen by the individual or persons choosing the individual.

$$\text{Stability Ratio} = \frac{\text{No. of choices} - \text{No. of persons}}{\text{No. of choices}} \times 100$$

When the total choices received by the individual on a number of tests and the number of different persons making these choices are used in the formula, it gives a measure of the proportion of people who repeatedly choose the subject. When total choices made by the subject on a number of tests and the number of different persons chosen are substituted, the formula gives a measure of the proportion of individuals whom the subject repeat-

TABLE VII
DISTRIBUTION OF STABILITY RATIOS

Ratio	Persons chosen by subject: RATIO M	Persons choosing the subject: RATIO R
0	9	9
1 - 9	—	—
10 - 19	5	4
20 - 29	10	20
30 - 39	12	7
40 - 49	3	3
50 - 59	2	—
60 - 69	1	—
70 - 79	—	—
80 - 89	—	—
90 - 99	—	—
100	1	—
N	43	43
Median	27.50	25.00
Mean	24.86	22.12
S.D.	15.67	11.74
"t" (means)	1.02	
r	.23	
"t"	1.47	

edly chooses. When a series of tests are given, the principle of moving averages can be employed to throw up the trends in individual Stability Ratios.

Two Stability Ratios, M (persons chosen by subject) and R (persons choosing the subject) have been calculated for each of our 43 subjects. The total choices within home B4, made and received by the subject on the three tests have been pooled to arrive at the ratios. Table VII gives the distribution of the two Stability Ratios.

The mean stability ratio R is slightly though not significantly less than ratio M indicating that choice by and towards the subjects is not distinguished by any marked difference in the stability of the behavior. The correlation .23 between the M and R ratios is not significant indicating that the two ratios are independently variable; a high M ratio may be associated with a high or low R ratio, though the chances are slightly in favour of the high R ratio.

Nine children show complete instability (ratio M = 0) in their choice of others, that is they choose different children on every test. One child shows complete stability (M = 100) though in fact this is because he made no choices on any of the three tests. Nine children show an R ratio of 0 indicating that they are chosen by different children on all three tests.

Neither ratio M nor ratio R are correlated with the subject's life age, mental age or I.Q., nor are they related to the length of time the subject has been resident in the institution. The stability of an individual's choice behavior towards others and the behavior of others towards him, when taken separately, are therefore not related to these characterstics which otherwise differentiate the group.

Some of the correlates of the stability of choice behavior by and towards the individual, which are of practical importance, may now be considered. Scrutiny of the daily reports submitted by the nursing staff to the Medical Superintendent during the six months of the investigation showed that of the 43 children in the group, 23 children had on 53 different occasions been reported for misbehavior. It should be emphasised that this step is taken only under exceptional circumstances. Of the 53 offences, 20 related to fighting and quarrelsome behaviors, 11 to absconding or attempting to run away, 10 to insolent behavior towards nurses, such as swearing and disobedience, 4 each to pilfering, destructive behavior such as breaking windows and 4 were miscellaneous observations relating to "queer" behavior. Of the 23 children concerned in these offences, 11 were involved in one, 5 in two,

2 in three, 4 in five and 1 child in six. The typicality of this behavior may be judged by comparing it with pooled ratings of seven judges on the goodness or badness of behavior, obtained prior to the investigation. These pooled ratings correlated significantly at .61 (r phi) with the frequency of bad behavior reports during the experiment. Of the 20 children who were not involved in any incidents, 55 per cent were previously rated above average, while of the other 23 children only 13 per cent were above average.

Stability ratios M and R correlated (r phi) at .28 and .31 respectively with the frequency of bad behavior reports, neither correlation being significant. There is a tendency for children who are more badly behaved to have below average stability ratios M and R, but though not significant statistically it is quite marked with ratio R and is of undoubted importance as will be seen. Ratio M does not distinguish between absconders and non-absconders, nor between those who are involved in fights and those who are not, though in the latter case there is a tendency for the fighters to have below average M ratios. On the other hand, 4 out of 5 (80 per cent) absconders have below average R ratios against 18 out of 38 (47 per cent) non-absconders; 10 out of 15 fighters (75 per cent) have below average R ratios against 12 out of 28 non-fighters (43 per cent).

In previous sections we have shown that the extent of and balance between an individual's choice of others and others choice of him—his social atom—is a structural unit that is characteristic for him and does not vary in a random manner. In giving a sociometric test we identify the individuals who comprise his social atom at that time. We have shown that the individuals who are embodied in the social atom by virtue of being chosen by the subject or choosing him change from test to test to a degree that we believe is characteristic for the individual. The stability of the internal structure of the social atom may be examined in terms of the balance between ratios M and R, that is, between the stability of his choice of others and the stability of others choice of him.

The balance between M and R ratios can theoretically range from 100:0 to 0:100; in the group the extremes are 100:0 and 0:38. On calculating the ratio of M over R and ordering the group in terms of this M:R balance, irrespective of the magnitude of either M or R, it was immediately obvious that the children who fell at the extremes were the most difficult children and those at the centre, the least difficult. Table VIII shows the M:R balance against both the number of bad behavior reports made during

TABLE VIII

THE RELATION BETWEEN M:R BALANCE AND (a) NO. OF BAD BEHAVIOR REPORTS AND (b) BEHAVIOR RATINGS

Ratio M ÷ R	(a) No. of bad behavior reports								(b) Behavior ratings				
	0	1	2	3	4	5	6	Total	1	2	3	4	5
M = 0, R = 0.			2					2			1	1	
M = +, R = 0.	1	–	1	2	–	2	1	7			1	3	3
2.0 & over		3						3		1	2		
1.10 - 1.99	5	3	1					9	2	2	2	2	1
.92 - 1.09	5	2						7	3	1	3		
.51 - .91	5	2						7	1	1	3	1	1
.50 & under						1		1					1
M = 0, R = +.	4	1	1	–	–	1	–	7	1	2	3		1
Total	20	11	5	2	–	4	1	43	7	7	15	7	7

TABLE IX

THE RELATION BETWEEN M:R BALANCE AND TYPES OF BAD BEHAVIOR

Ratio M ÷ R	Type of behavior						Total incidents	Proportion of subjects involved
	F	A	I	D	P	X		
M = 0, R = 0.	1	1	2				4	2 out of 2
M = +, R = 0.	7	9	2	1	2	3	24	6 " " 7
2.0 & over	2	–	1				3	3 " " 3
1.10 - 1.99	1	–	3	–	1		5	4 " " 9
.92 - 1.09	1	1					2	2 " " 7
.51 - .91	1	–	–	–	1		2	2 " " 7
.50 & under	2	–	–	2	–	1	5	1 " " 1
M = 0, R = +.	5	–	2	1			8	3 " " 7
Total incidents	20	11	10	4	4	4	53	
No. of subjects showing behavior	15	5	9	3	4	2		23 " " 43

F — fighting
A — absconding
I — insolence
D — destruction
P — pilfering
X — miscellaneous

the investigation and the behavior ratings made prior to the investigation. Table IX relates qualitative differences in bad behavior to various levels of M:R balance.

Two children show complete instability both in their choice of others and in others choice of them. Both children were reported twice for bad behavior and on a five point scale of behavior they rated 3 and 4 respectively. During the investigation the misbehavior common to them both was rudeness to the staff, in concert with others.

Seven children show marked imbalance with complete instability in others' choice of them. The M ratios for this group ranged between 20 and 100 per cent. With only one exception all of this group have been reported at least twice for bad behavior and on the behavior scale they rated, one at 3, three at 4 and three at 5. Three of the five children who absconded or attempted to abscond are found in this group and between them they accounted for nine of the eleven incidents. It is significant that this pattern is typical with absconders, for it suggests that absconding is far more likely among children who seem to be incapable of behavior in the group that results in their being persistently chosen by the same individuals. Five of the seven children at this level were reported for fighting and aggressive behavior towards other children and it may be noted that the three absconders featured in this group too. Children who show such a marked imbalance and instability in their social atoms are the major problem group in the institution.

At the other extreme of the distribution, the seven children who show marked imbalance between the M and R ratios, with complete instability in their choice of others, do not as a group show markedly bad behavior, four of the children not being reported during the investigation. Three children who were reported were involved in one, two and five incidents, all were involved in fights and two were rude to staff. On the behavior ratings, three have above average ratings (1 or 2), three are average (rating 3) and only one had a below average rating of 5. Imbalance in the social atom which shows some stability in the choice by the group towards the individual is seen to be less serious on the whole than the reverse position. The child who even though not exhibiting stable choice behavior towards the group, is himself the focus of some amount of stable choice, is less liable to misbehave than the child who though exhibiting some stability of choice towards others is not himself the recipient of any persistent choice.

Working from the extreme positions towards the centre of the distribution, it can be seen that children who though showing M and R ratios

of greater than 0 have a marked imbalance between them, tend to resemble the extremes both in respect of the proportion who are reported for bad behavior and the level of their behavior ratings. Though instances of children behaving aggressively towards others occur at all levels, by far the greatest proportion occur at the extremes. Seven of the fifteen such children have an M:R balance of 2:1 or greater and four have an M:R balance of 1:2 or greater.

Seven children have M:R ratios falling within the range .92 to 1.09. Though they do not differ from the seven children having ratios of .51 to .91 with respect to incidence of bad behavior, they are seen as a group to be clearly superior to all other groups with respect to behavior ratings. Satisfactory behavior then is closely related to the achievement of a one to one balance between the stability of behavior towards others and from others, providing that there is some stability, no matter the level. Mild imbalance in the social atom resulting from a lower stability of choice towards the individual appears to be associated with disobedience and insolence, the more extreme the imbalance the greater is the probability of aggressive antisocial behavior and escape from the situation by absconding. Imbalance resulting from a lower stability of choice by the subject is on the whole less serious, but the more extreme cases, as well as being involved in fights resulting from their touchy behavior, loose their aggression on the impersonal environment such as windows and furniture and are prone to indulge in colourful displays of verbal aggression.

The stability of the individual's personal relations with other children, operationally defined by the M and R ratios is therefore seen to be of importance in the recognition and understanding of the various kinds of behavior disorder manifested by this particular group of children. Thus, use of such concepts may, we feel, prove useful not only in the design and evaluation of therapeutic endeavor in the institution, but in the study of intra-group tensions generally.

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RELATIONSHIP BETWEEN THE SOCIOMETRIC STATUS OF PUPILS AND TEACHERS' PREFERENCES FOR OR AGAINST HAVING THEM IN CLASS

NORMAN E. GRONLUND
University of Illinois

There is increasing evidence that the number of choices children receive on a sociometric test is related to their social adjustment in the classroom. Several studies (1,2,4,5) have shown that pupils who receive the largest number of choices are frequently described by their classmates as being friendly, cheerful, enthusiastic, and possessing other behavior characteristics which are generally considered to be socially desirable. Those receiving few or no choices are often identified by their classmates as pupils who have socially ineffective behavior characteristics which interfere with their social adjustment among peers.

This relationship between the number of choices received on a sociometric test and significant behavior characteristics is not limited to peer evaluations. A study by Olson (6) has revealed that there is a similar relationship between the number of choices pupils receive on a sociometric test and the teachers' evaluations of their behavior. In general, those pupils receiving the largest number of choices were characterized by the teachers as being good-natured, quiet, friendly, well adjusted and dependable; while those receiving fewer choices were characterized as being shy, bossy, sulky, ill, conduct problems, or new to class. These studies tend to show that the sociometric test is measuring significant aspects of behavior and the teachers' evaluations of that behavior are similar to the evaluations by the pupils. In light of these findings it would seem important to determine the extent to which teachers prefer the same pupils that the class members prefer. This should provide some additional insights into the relationship between pupil-pupil adjustment and pupil-teacher adjustment.

Specifically, this study is an attempt to determine the relationship between teachers' preferences for or against having certain pupils in class and the number of choices those pupils receive on a sociometric test.

METHOD OF INVESTIGATION

The data for this study were collected in connection with a previous investigation.[1] A sociometric test was administered to forty sixth-grade

[1] For a detailed description of the instruments used, subjects participating, and method of collecting data see Norman E. Gronlund, *The Accuracy of Teachers' Judgments Concerning the Sociometric Status of Sixth-Grade Pupils.* Sociometry Monographs, No. 25, New York: Beacon House Inc., 1951, pp. 62.

classes during the latter part of May. In each class the pupils were asked to choose the five classmates whom they would most prefer as work companions, play companions and seating companions. In the same forty classes each teacher was requested to choose the three boys and three girls she most preferred as pupils in class, and the three boys and three girls she least preferred as pupils in class. These preferences were to be based entirely on how much the teacher did, or did not, enjoy having them as pupils in her class.

There were 1,258 pupils in the forty sixth-grade classes. Of these, 632 were boys and 626 were girls. All of the teachers in this study were women.

Results of the Sociometric Testing

The sociometric results were analyzed by counting the number of choices each pupil received on the sociometric test. Each choice was given a value

TABLE I

Distribution of Boys and Girls in Forty Sixth-Grade Classes on the Basis of the Number of Choices Received on the Sociometric Test

Number of Sociometric Choices Received	BOYS		GIRLS	
	Frequency	Per Cent by Classification	Frequency	Per Cent by Classification
		Isolates (unchosen)		Isolates
0	14	2	21	3
1-3	62	Neglectees	53	Neglectees
4-6	83	36	83	35
7-9	80		82	
10-12	81	Low Average	79	Low Average
13-15	69	24	69	24
16-18	68	High Average	70	High Average
19-21	47	18	36	17
22-24	43		42	
25-27	25		24	
28-30	21		29	
31-33	14	Stars	12	Stars
34-36	10	20	8	21
37-39	7		8	
40-42	3		3	
43-up	5		7	
TOTAL	632	100	626	100

of one regardless of criterion or level of choice. In the process of tabulation the number of cross-sex choices was noted. Since only eight per cent of the boys' choices went to girls and seven per cent of the girls' choices went to boys, it was decided to present the sociometric results separately for boys and girls.

The distribution of sociometric choices for all forty sixth-grade classes is presented in Table I. The method of classifying the groups into isolates, neglectees, low average, high average, and stars is based on Bronfenbrenner's fixed frame of reference (3). He has shown that fifteen choices is the expected value where five choices are allotted for each of three criteria. In this sociometric setting he has further shown that nine choices or less, and twenty-two choices or more, is to be expected by chance less than two times in a hundred. It was decided that the use of these limits of statistical significance would be more meaningful, for the purposes of this study, than making arbitrary divisions.

An examination of Table I reveals that the percentage of pupils falling into each category is approximately the same for boys and girls. The large percentage of pupils in the neglectee category is a normal phenomenon in sociometric testing. Although it is not revealed in this table, the pupils in each classification were fairly well distributed among the forty classes. There were thirteen classes with boys identified as isolates (unchosen) and sixteen classes with girls in the same category. All of the classes had pupils in the neglectee classification and thirty-eight of the classes contained pupils classified as stars.

Relationship Between Sociometric Results and Teachers' Preferences

Since the forty teachers were requested to choose the three boys and three girls they most preferred as pupils in class, and the three boys and three girls they least preferred as pupils in class, each teacher could choose only twelve pupils. Consequently, 480 pupils, or approximately 38% of the total pupil population were included in the teachers' preferences.

To determine if there was a relationship between the teachers' preferences and the number of choices received on the sociometric test the data were analyzed in the following manner. In the forty sixth-grade classes the number of choices received on the sociometric test were averaged separately for boys and girls in each of the preference groups. The average number of choices received by the 120 pupils in each preference group is referred to as their mean sociometric status.

An examination of Table II reveals that the mean sociometric status of those pupils most preferred by the teachers is more than double the mean sociometric status of those pupils least preferred by the teachers. An application of the Fisher T-test has shown that these differences between preference groups are significant for both boys and girls. A further analysis of Table II will reveal that the mean sociometric status of boys and girls is almost identical in the most preferred group and is identical in the least

TABLE II

COMPARISON OF THE MEAN SOCIOMETRIC STATUS OF THE THREE MOST PREFERRED AND THE THREE LEAST PREFERRED BOYS AND GIRLS IN FORTY SIXTH-GRADE CLASSES

	N	Mean Sociometric Status	
		Most Preferred by Teachers	Least Preferred by Teachers
Boys	120	21	9
Girls	120	22	9

preferred group. This is somewhat surprising since it has been shown by Tryon (7) that, at this age level, girls are more apt to achieve their peer status on the basis of behavior characteristics that are appealing to teachers, while boys are more likely to achieve their status through aggressive, boisterous behavior which does not conform to teachers' standards of desirable behavior. On the basis of her findings it would be expected that the teachers' preferences would be more closely related to the sociometric status of girls than to that of boys. These data are inconsistent with that hypothesis.

Since there is a relationship between the sociometric status of pupils and the teachers' preferences it would appear valuable to make a further analysis of that relationship. In Table III the sociometric classification of pupils most and least preferred by the teachers is compared, and related to the sociometric classification of all pupils taking the test. It will be noted, in this table, that the distribution of pupils on the basis of the teachers' preferences is similar for boys and girls. The most revealing finding, however, may be obtained by comparing the relative number of most and least preferred pupils in each sociometric classification. Only eleven per cent of the boys and girls *most preferred* by the teachers are classified as isolates or neglectees while approximately half of them are classified as stars. In contrast, between fifty-six and fifty-eight per cent of the boys and girls *least preferred* by the teachers are isolates or neglectees and only a small per cent fall in the star category.

TABLE III

RELATIONSHIP BETWEEN THE DISTRIBUTION OF BOYS AND GIRLS ON THE BASIS OF THE SOCIOMETRIC TEST AND THE DISTRIBUTION OF BOYS AND GIRLS ON THE BASIS OF THE TEACHERS' PREFERENCES IN FORTY SIXTH-GRADE CLASSES

Group	N	Per Cent			
		Isolates & Neglectees	Low Average	High Average	Stars
All Boys	632	38	24	18	20
Boys Most Preferred by Teacher	120	11	19	23	47
Boys Least Preferred by Teacher	120	56	28	13	3
All Girls	626	38	24	17	21
Girls Most Preferred by Teacher	120	11	18	20	51
Girls Least Preferred by Teacher	120	58	24	14	4

The tendency for teachers' preferences to be related to the pupils' choices on the sociometric test is even more pronounced than is revealed in Table III. Some of the classes had less than three boys and three girls in the isolate and neglectee classification and some had less than three boys and three girls in the star classification. Consequently, there were fewer pupils available in these categories than there were choices allotted to teachers. This forced some of the teachers' preferences into the average category.

To compensate for the above tendency it was decided that an analysis, based on the number of pupils available in each sociometric classification, would be meaningful. The following three tables reveal the number of pupils available for the teachers' preferences in each category, and the number and per cent that are most and least preferred by the teachers.

It will be noted in Table IV that none of the isolates were *most preferred* by the teachers, but approximately one-third of them were *least preferred.* It appears that the lack of acceptance these pupils experience among their classmates is similar to their lack of acceptance by teachers. It is not surprising that approximately two-thirds of the isolates were neither most nor least preferred by their teachers. A clinical study (5) of the personality traits of children in the lowest sociometric group has shown that a large

proportion of them are quiet, retiring children who attract neither positive nor negative attention in the classroom.

TABLE IV

PERCENTAGE OF ISOLATES MOST AND LEAST PREFERRED BY TEACHERS IN FORTY SIXTH-GRADE CLASSES

	Number Available for Teachers' Preferences	Most Preferred by Teachers		Least Preferred by Teachers	
		Number	Per Cent	Number	Per Cent
Boys	14	0	0	5	36
Girls	21	0	0	8	38
Total	35	0	0	13	37

Table V reveals that only eleven per cent of those neglectees available for teachers' preferences were *most preferred* by the teachers, while fifty-eight per cent were *least preferred*. Although there is a strong tendency here for the teachers' preferences to agree with the sociometric choosing it seems possible for a minority of pupils to attain satisfactory relationships with their teachers even though they have relatively little status among their classmates. There could be several possible explanations for this phenomenon. First, the teachers made their preferences on the basis of their general reaction to the pupils while the pupils based their choices on specific criteria. Second, the value systems of teachers and pupils differ in respect to what is desirable behavior in children. Specifically, a relatively quiet, mild mannered child may not attract a large number of friends, but his behavior could be

TABLE V

PERCENTAGE OF NEGLECTEES MOST AND LEAST PREFERRED BY TEACHERS IN FORTY SIXTH-GRADE CLASSES

	Number Available for Teachers' Preferences	Most Preferred by Teachers		Least Preferred by Teachers	
		Number	Per Cent	Number	Per Cent
Boys	117	13	11	67	57
Girls	116	13	11	69	59
Total	233	26	11	136	58

very appealing to the teacher. Third, a pupil's relationship with his teacher may be the cause of his low status among his classmates. An extreme example of this would be the "teacher's pet", whereby excessive attention from the teacher could cause him to lose status among his fellow pupils.

There may be other possible explanations to account for the teachers most preferring some of the pupils who received relatively few choices on the sociometric test. Further investigation would be needed to provide definite answers.

Table VI presents the percentage of stars most and least preferred by the teachers. It can readily be seen that very few stars are *least preferred* by the teachers. In contrast, sixty per cent of them are *most preferred.* Children who receive enough choices on the sociometric test to classify them as stars apparently have behavior characteristics that attract the favorable

TABLE VI

PERCENTAGE OF STARS MOST AND LEAST PREFERRED BY TEACHERS IN FORTY SIXTH-GRADE CLASSES

	Number Available for Teachers' Preferences	Most Preferred by Teachers		Least Preferred by Teachers	
		Number	Per Cent	Number	Per Cent
Boys	96	57	59	4	4
Girls	100	61	61	5	5
Total	196	118	60	9	4.5

attention of teachers as well as that of their peers. The relatively few that were least preferred may well be pupils that achieved their sociometric positions through aggressive behavior which did not conform to the teacher's standards of classroom conduct. It is easy to visualize how such behavior could attract positive reactions from a number of classmates, and at the same time bring forth negative reactions from the teachers. This would be especially probable where the teacher was not too well accepted by a majority of the class members.

SUMMARY AND FINDINGS

This study was an attempt to determine the relationship between the sociometric status of pupils and the teachers' preferences for or against having them in class. A sociometric test allotting five choices for each of three criteria was administered to forty sixth-grade classes. In the same classes each teacher was requested to choose the three boys and the three girls she most and least preferred. An analysis and comparison of the data revealed the following findings.

1. The pre-adolescent sex cleavage was very evident in the sociometric choosing. Only eight per cent of the boys' choices went to girls and seven per cent of the girls' choices went to boys.

2. The distribution of the 632 boys was very similar to the distribution of the 626 girls on the sociometric test. On the basis of the number of choices received between two and three per cent of the pupils were classified as isolates, between thirty-five and thirty-six per cent were classified as neglectees, between twenty and twenty-one per cent were classified as stars, and between forty-one and forty-two per cent were in the average category.

3. There is a significant difference between the sociometric status of those pupils the teachers *most prefer* and those pupils the teachers *least prefer*. This difference is in the direction of a higher sociometric status by those pupils in the most preferred group.

4. There is *no* significant difference between the sociometric status of boys and the sociometric status of girls most preferred by the teachers. There is, likewise, *no* significant difference between the sociometric status of boys and the sociometric status of girls least preferred by the teachers.

5. Approximately half of those pupils *most preferred* by the teachers were in the star category on the basis of the sociometric choosing. None were classified as isolates and only eleven per cent were in the neglectee classification.

6. Of those pupils *least preferred* by the teachers more than half were classified as isolates or neglectees on the basis of the sociometric test. Less than four per cent were in the star category.

These findings reveal that there is a general tendency for teachers to most prefer those pupils that are highly chosen on the sociometric test and to least prefer those pupils that receive relatively few choices. This would seem to indicate that the number of choices received on a sociometric test reflects significant aspects of behavior which not only determines a pupil's acceptance by his peers but also his acceptance by teachers with whom he comes in contact. It is hoped that further studies in this area will reveal those behavior characteristics, related to sociometric status, that contribute to teacher-pupil adjustment as well as to pupil-pupil adjustment.

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PERSONALITY PATTERNS OF SOCIOMETRICALLY SELECTED AND SOCIOMETRICALLY REJECTED MALE COLLEGE STUDENTS[1]

CYRIL R. MILL
Richmond Public Schools
Richmond, Virginia

It is becoming increasingly important for teachers, counselors, and other persons working with groups not only to determine the sociometric relationships existing within their groups, but also to have some knowledge of the personality characteristics which are frequently associated with social selection and rejection. While it is not possible, of course, to apply uncritically the findings of disparate studies to the group with which one happens to be dealing, there are definite consistencies which appear when one examines the literature in this area. Most attempts to study the personality characteristics of popular and unpopular individuals have been conducted with questionnaire or rating scale methods (2, 6, 8, 11). These studies are in general agreement that reject status is frequently associated with emotional disturbance of more or less severity and that this disturbance may have been one of long standing. Northway and Wigdor (7) present one of the few studies where the Rorschach was employed to investigate the personality patterns of sociometrically selected groups. In their population of eighth-grade children, it was found that low sociometric status was usually associated with recessive, schizoid, psychoneurotic patterns, and inefficiently aggressive behavior. Their select group appeared to be energetic, constructive, and to possess a greater sensitivity to their environment. The selects were found to be conventional, and there was a tendency among them toward a strong need for affection. It was also concluded that both the rejects and selects contained more disturbed individuals than did the middle group. There is a need for further research in this area employing the more intensive techniques of personality investigation, if other than superficial aspects of personality are to be detected. The present study is an attempt to meet this need, in part, through an intensive analysis of the personality patterns of rejects and selects in a college group. It may be considered a continuation of the study under-

[1] A modification of a portion of a thesis submitted to the Department of Psychology of Michigan State College in partial fulfillment of the requirements for the Ph.D. degree.

taken by Kidd (5) since both studies were done in the same location and utilized, in part, the same subjects. Kidd's study revealed information concerning the home background of selects and rejects, their behavior in a college environment, and their interpersonal relationships. There remained, however, the question as to what a study of the personality of individuals sociometrically selected might add to the knowledge already accumulated about the popular or unpopular person.

The Problem

The problem was to make a personality study of a group of male college students who had been shown, on the basis of a sociometric survey, to be the most popular individuals in a college men's dormitory, and to compare them with the group of men who had been found to be the most unpopular.

In order to obtain a picture of the personality structure of each subject and to determine the presence of neurotic or psychotic manifestations, the Rorschach technique was selected. The Minnesota Multiphasic Personality Inventory (MMPI) was used not only because it provides the investigator with a variety of data concerning attitudes and diagnostic classifications but also because it provides test results more capable of statistical manipulation than does the more wholistic approach of the Rorschach. Since the area of interpersonal relations and the needs which affect these relations were deemed to be an important feature of social selection and rejection, the Thematic Apperception Test (TAT) was included in the battery. If the validity of these techniques can be accepted, each of them would provide information concerning somewhat different aspects of personality.

Subjects

The subjects used were determined by a sociometric study of dormitory residents done by Kidd as a follow-up to his research of the previous year. The reject group was composed of the 21 men who, out of approximately 600 residents, were rejected more frequently than they were selected. The select group consisted of the 21 men most frequently selected in the sociometric study.

The mean age of the rejects was 20 years; of the selects, 22 years, with the difference significant at the one per cent level. The groups were also significantly different in that the rejects were less advanced in school, and

they were making lower grades. However, there was no significant difference in potentiality for academic success as measured by the ACE Test.

RESULTS

The MMPI

Table I presents the mean raw scores for each group on the sixteen MMPI scales and Fisher's *t* for the significance of the difference between the means.

TABLE I

Comparison of the Groups on Means of Raw Scores for Sixteen Minnesota Multiphasic Scales

Scale[a]	Selects Mean	SD	Rejects Mean	SD	*t*
L (Lie scale)	2.7	1.6	3.0	1.9	.455
F (Eccentricity)	3.2	1.8	5.5	3.8	2.449*
K (Defensiveness)	16.9	4.9	12.7	4.0	2.907**
Hs (Hypochondriasis)	3.4	2.6	4.3	2.5	1.102
D (Depression)	15.2	2.3	16.8	4.0	1.547
Hy (Hysteria)	19.4	3.6	18.5	3.4	.797
Pd (Psychopathic deviate)	14.4	2.2	18.6	5.1	3.384**
Mf (Masculine-feminine)	24.4	3.5	25.3	4.7	.681
Pa (Paranoid)	8.7	2.4	8.6	2.0	.140
Pt (Psychasthenia)	8.1	5.7	12.7	6.5	2.392*
Sc (Schizophrenia)	9.1	5.0	14.1	8.0	2.345*
Ma (Manic)	16.7	3.1	19.8	4.5	2.528*
Responsibility	21.9	2.9	18.8	4.3	2.661*
Dominance	16.9	2.5	15.9	3.4	1.055
Status	23.0	3.5	22.7	3.9	.338
Social-Introversion	20.5	7.3	21.1	6.8	.831

* Significant at the five per cent level.

** Significant at the one per cent level.

[a] Scale identification should not be interpreted literally.

The table shows that differences which were significant at the five or one per cent level occurred on seven of the scales.

The rejects were significantly higher than the selects on the F scale, indicating that among them there appeared to be more unusual or eccentric thinking. On the K scale, which purports to measure "test-taking attitudes," the selects exceeded the rejects to a very significant degree. The selects, as a group, seemed to be more aware of a feeling of self-esteem and tended

to strive consciously or unconsciously to protect and enhance this feeling. Being "citizens in good standing," as it were, they would have more to lose were they to reveal socially disapproved strivings by their test responses. On the other hand there was among the rejects a lack of this self-esteem, a dissatisfaction which resulted in a frank, self-critical attitude.

The greatest difference between groups was found on the Pd (Psychopathic Deviate) scale, with the reject mean being higher, and the difference significant beyond the one per cent level. When this finding is combined with other MMPI psychopathic indicators, such as Sc (Schizophrenia) greater than Pt (Psychasthenia), and an F score higher than other clinical groups, there appeared a definite tendency for rejects to respond to the test in a manner characteristic of psychopaths.

No significant differences appeared on the Hs (Hypochondriasis), D (Depression), and Hy (Hysteria) scales, which are the scales frequently associated with neuroticism. The results on the Mf (Masculine-Feminine) scale point to the possibility that among both groups there was a lack of masculine identification with feminine interest patterns much in evidence.

On the scales making up the psychotic phase of the profile, Pa (Paranoia), Pt (Psychasthenia), and Sc (Schizophrenia), the reject mean was higher for Pt and Sc. This indicates that disturbances of a more serious nature probably were more frequent among the rejects than they were among the selects.

The rejects, being significantly higher on the Ma (Hypomania) scale, showed a tendency to overreact in a hypomanic fashion. Since the pattern of the other scales indicated the presence of greater psychopathic deviation and more serious (psychotic) symptomatology, this emphasized the trends in these directions.

The selects indicated a greater willingness to accept responsibility as indicated by their scores on the Responsibility scale. The groups did not differ significantly on any of the final three scales, D (dominance), St (status), and S-I (social-introversion).

Profile Elevation

Comparison of the groups in mean height of the profile in T score units revealed a reject mean of 55.5, select mean of 53.6, with the difference significant at the one per cent level. This provided further evidence of a greater degree of maladjustment among the rejects, and also suggested that, according to the MMPI, neither the selects nor rejects were a normally adjusted group.

The Anxiety Index and Internalization Ratio

An objective measure of anxiety which can be reported in a single score has been proposed by Welsh (9). Anxiety is presumed on the basis of test items where the subject complains of subjective feelings of tension, nervousness, apprehension, fear, accompanied by somatic concomitants such as vertigo, dyspnea, pre-cordial pain, gastric distress, headache, and the like. It is defined so as to yield an expected value of 50 for a normal record. It was found that the mean AI of the rejects in the present study was 53.7; of the selects, 45.5; with the difference significant beyond the one per cent level. Thus, the MMPI indicated that the rejects suffered more anxiety as a group.

On the internalization ratio (IR), another concept proposed by Welsh (9), the groups were not found to differ significantly. The IR purports to differentiate between those who tend to have many somatic symptoms and subjective feelings of stress—who "internalize" their difficulties—and those who tend to act out and "externalize" their conflicts. Both groups of the present study tended to externalize their conflicts, but the low t ratio indicated that there was no significant difference between the groups in the extent to which this tendency was present.

The Subtle and Obvious Keys

Wiener (10) divided all items of the MMPI into two groups: those easy to detect as indicating emotional disturbance (obvious), and those relatively difficult to detect (subtle). The tentative hypothesis which he derived was stated as folows:

> Successful adjustment in society requires knowledge of socially acceptable ways of behavior and the desire and ability to act in these ways. The socially acceptable way to behave on the personality test, as well as more overtly, seems to include avoiding deviate behavior. On the MMPI, the most deviate items are the O items, "deviate" because they are seldom answered in a significant direction by a normal population. The socially successful person may have the ability to recognize and to avoid making scores on personality test items which obviously indicate maladjustment, while the socially unsuccessful person may be unable to recognize or to heed signs of deviate behavior on a personality test (10, p. 3).

S and O keys were not made for all the scales. Hs, Pt, and Sc were found to consist almost entirely of obvious items and Mf probably has too low a validity as a scale to yield positive results. As has already been

seen, the rejects indicated a significant tendency toward high scores on the obvious items making up the Pt and Sc scales. There was a trend in the same direction on the Hs scale, and no difference between groups on the Mf scale. Table II presents the results of comparing the groups on the other five scales for responses to the S and O items.

TABLE II

COMPARISON OF THE GROUPS ON MEAN T SCORES OF THE SUBTLE AND OBVIOUS SCALES OF THE MINNESOTA MULTIPHASIC INVENTORY

	Mean T Scores		
	Selects	Rejects	*t*
Obvious Scales			
D-O	46.1	51.7	1.879
Ma-O	50.7	56.2	1.815
Hy-O	47.6	50.9	1.336
Pd-O	49.3	57.0	2.283*
Pa-O	46.9	49.5	.977
Subtle Scales			
D-S	51.5	47.4	1.353
Ma-S	57.2	57.0	.005
Hy-S	60.3	54.1	2.324*
Pd-S	53.1	59.1	2.085*
Pa-S	59.3	54.1	1.948

* Significant at the five per cent level.

The hypothesis was that the rejects, similar to the population of "unsuccessful" persons of Wiener's study (10), would receive higher scores on the obvious scales than the selects. This occurred, with the difference on the Pd-O scale being significant at the five per cent level. To the extent indicated, therefore, the rejects were unable to avoid the obviously deviate items, in accordance with Wiener's thesis.

Wiener also noted (10, p. 6) a tendency for socially successful groups to obtain higher S scores than unsuccessful groups. Table II shows that in the present study the selects were higher on all S scales except Pd-S.

Ratings for Level of Adjustment

The individual profiles of the entire group, numbered and mixed at random, were submitted to three judges for rating as to level of adjustment.[2]

[2] The writer wishes to thank Dr. Joseph Adelson, Mrs. Esta Berg Thomas, and Mr. William E. Thomas for performing these ratings.

The rank order coefficients of the ratings between judges ranged from .68 to .90, indicating considerable agreement as to the adjustment of the subjects based on the MMPI profiles.

A single rating for level of adjustment was obtained for each subject by averaging the three ratings that had been assigned him. The group was then divided at the twenty-first (middle) rank and the chi square test applied to test the null hypothesis that there would be no difference between groups in the number falling in the upper, or better adjusted half. In the upper half there were thirteen selects and eight rejects. Chi square was 1.892, P between .10 and .20. Thus the null hypothesis was upheld; the difference between level of adjustment according to judges' ratings was not significant.

The Rorschach

Method of Analysis

The Rorschach test was administered to 20 of the rejects and 18 of the selects. After the protocols were scored according to the method proposed by Beck (1), the groups were compared on each of the scoring categories by tests of significance. The protocols were submitted to judges for rating, and then they were interpreted in the usual clinical manner.

The median number of responses was found to be 36 for ***both*** groups. The range of responses, however, was quite large in both groups. As Cronbach (3) pointed out, mean scores of the Rorschach scoring categories cannot be directly compared where response totals differ. A method suggested by Cronbach (3, p. 411) was used to equate the records for number of responses. For each variable (sum of C, number of P, per cent A, etc.) a scattergram was prepared with the variable along the Y axis, and number of responses along the X axis. The variable was plotted against R for all 38 subjects and medians determined for each column of 10 responses. A line was drawn to fit the medians of the columns using a formula determined by the method of averages. Then the proportion of the 38 cases which fell above the line of medians was determined for each group. These proportions were compared by chi square.

Table III presents the results obtained when the groups were compared in this manner.

Except for the comparison of F+%, none of the P values reached the five or one per cent levels usually demanded before a conclusion is reached that a real difference exists between groups. The lack of significant differences where one might expect them, on a priori grounds, to appear, may

TABLE III

RORSCHACH ANALYSIS: COMPARISON OF SCORING CATEGORIES AFTER EQUATING THE PROTOCOLS FOR NUMBER OF RESPONSES

Variable	Number above the median		Proportions	X^2	P
F+%	S	0[a]	.000	8.727	.01
	R	6	.158		
C, sum of	S	9	.237	.143	.70
	R	16	.421		
Pure C	S	9	.237	.060	.80
	R	9	.237		
FC	S	11	.290	.124	.80
	R	11	.290		
M	S	8	.210	.032	.85
	R	9	.237		
M > C	S	8[b]	.210	.655	.45
	R	6	.158		
M < C	S	9	.237	.934	.35
	R	13	.344		
Y, sum of	S	6	.158	2.758	.10
	R	12	316		
V, sum of	S	6	.158	2.758	.10
	R	12	316		
Whole	S	8	.210	.429	.50
	R	11	.290		
Detail	S	9	.237	2.620	.10
	R	15	.395		
Dd (small detail)	S	8	.210	.122	.70
	R	10	.263		
Popular	S	9[c]	.237	.934	.35
	R	13	.344		
Space	S	13	.344	1.152	.20
	R	11	.290		

TABLE III (Continued)

RORSCHACH ANALYSIS: COMPARISON OF SCORING CATEGORIES AFTER EQUATING THE PROTOCOLS FOR NUMBER OF RESPONSES

Variable	Number above the median		Proportions	X^2	P
Human and Human detail	S	8	.210	.032	.85
	R	9	.237		
Animal %	S	10[d]	.263	.612	.45
	R	8	.210		
Anatomy	S	8	.210	.122	.70
	R	10	.263		
Sex	S	9[e]	.237	1.583	.20
	R	6	.158		

[a] For F+% the comparison was between the proportion of each group falling below a cutting score of 60%.

[b] The comparison of M/C ratios was between number of subjects having the designated pattern in each group, regardless of number of responses.

[c] Chi square for number of subjects in each group obtaining a P outside the range 2 to 9 was .534.

[d] Chi square for number of subjects in each group obtaining an A% outside the range 30 to 65 was .826.

[e] Sex responses were compared by dichotomizing the subjects into those giving no sex responses and those giving one or more sex responses.

indicate that the Rorschach variables were not sufficiently sensitive for group comparisons in this case. This might be particularly true when, as in the present instance, both groups were composed of comparatively "normal" (nonhospitalized) individuals.

It may be noted, however, that some of the trends indicated here were present in the MMPI results, at satisfactory levels of significance. In thus having two sources of evidence, these results may be regarded as having more credibility than the low levels of significance in the Rorschach alone would warrant.

Comparison of Individual Scoring Categories

The most highly significant result was the comparison of form level (F+%); where it was found that there were among the rejects more individuals whose percepts were widely deviant. These individuals, responding to their environment in a manner which digressed so far from the norm,

were possibly disturbed persons whose emotional instability would be reflected in impaired interpersonal relationships.

A very high F+% is also an unfavorable sign. The highest F+% score among the selects was 85, well within normal limits. The reject group contained one individual who obtained an F+% of 100. The latter score is an indication of extreme rigidity, self-guarding, or evasiveness, which would make him a difficult person with whom to be associated.

The groups did not differ in their affectivity (response to color) nor in amount of fantasy activity (human movement, or M responses).

There was a trend for the rejects to give more responses to the shaded areas of the blots (Y) and to produce more vista responses (V). Such responses are thought to indicate a tendency toward anxiety and inferiority feelings. Their occurrence among the rejects perhaps had great significance in their interpersonal relationships. The conclusion that the Y responses reflected the presence of anxiety in the reject group was given greater assurance since they also revealed more anxiety on the anxiety index of the MMPI.

It was found that the rejects tended to respond to the large details (D) more than did the selects, but that there was little difference between groups in responses to the whole blot (W) or small details (Dd). In thus attending more to the obvious the rejects reflected their passivity and an anergic state already implied in the low ego strength (F+%) and the relatively high frequency of shading responses.

No difference between groups was found in frequency of popular (P) responses. While one reject gave only two popular responses, the frequency of P responses among the rest of the rejects contra-indicated labelling them as schizophrenic on the basis of this single variable. It was found that one of the selects gave 14 P responses. Such excessive conformity was significant in his case as an attempt to cover up homosexual tendencies portrayed in the rest of his record.

The meaning of the trend for selects to give more responses utilizing the white space (S) is indeterminate since response to white space can signify different things in different records. According to Beck (1, Vol. II, p. 47), white space selection may be associated with contrariness or, in the healthy individual, resolution and perseverance. It may represent determination and will power. That these attributes might be expected in persons of great popularity seems reasonable.

Of the content categories, the only trend noted was for the selects to give more sex responses. This might indicate a lesser degree of repression or inhibition in regard to sexual material among the selects. The select group contained a number of veterinary medicine students who, upon responding to sexual areas of the blots frequently construed them as the sexual organs of animals. Other selects who were studying forestry structured these same areas as "reproductive system of a flower," or a similar botanical response. Such a handling of sexual percepts seemed to allow these subjects not only to see, but to verbalize sexual material in a socially acceptable manner. Only one of the rejects gave a "sublimated" sexual response of this sort.

The oligophrenic (Hdx or Adx) response occurred in the records of two subjects in each group. The position response (Po) was given by one subject in each group. While these responses were rare, their equal distribution between groups was remarkable. That these indicators of more serious pathology were found in both groups emphasizes the fact that maladjustment may be present to a certain degree in both the selects and rejects, and that the assumption cannot be made that popularity is equivalent to, or the resultant of, an absence of pathology.

Ratings for Level of Adjustment

The Rorschach protocols and the scoring summaries were submitted to three judges who were asked to rank the protocols in order, from that representing the best adjustment to that representing the poorest adjustment.[3] The rank order coefficients between judges ranged from .39 to .70. While a higher level of agreement would have been desirable, even the lowest of these coefficients was significant at the five per cent level.

When the subjects were placed in order according to their composite ranks, nine selects and ten rejects were in the upper half of the distribution. This was exactly half of each group, and indicated that in the opinion of the judges there was no difference between the groups in level of adjustment on the basis of the Rorschach protocols. This finding was similar to that obtained in judging the MMPI profiles.

The Rorschach Interpretations

Upon interpreting the Rorschach protocols the many fears, moods, conflicts, and bizarre thought patterns which could contribute to rejection

[3] The writer is indebted to Miss Margaret Clark, Mrs. Esta Berg Thomas, and Mr. William E. Thomas for rating the Rorschachs.

became apparent. However, it was more difficult to account for select status than reject status from the Rorschachs, partly because popularity seems to be the result of an absence of disagreeable traits as well as the possession of positive methods of dealing with other persons. Many of the selects had developed methods of handling interpersonal relationships which consisted of techniques and behavioral traits not reflected in their Rorschach protocols. Some possessed prestige-giving talents.

The Rorschach revealed areas of conflict in most individuals of both groups. What was less distinctly revealed was the degree to which the conflict had pervaded the entire personality, and the methods adopted by each subject in handling his conflicts. It is believed that these two factors are crucial in determining the ease with which one establishes favorable relationships with his fellows.

The degree to which the conflict had pervaded the entire personality was reflected to some extent in the F+%. When the conflict had reached such serious proportions as to alter one's perception and thinking significantly from the norm, it could be expected that his interpersonal relationships would suffer.

While several of the selects indicated the presence of conflicts, they seemed to be handling them in such a way that the presence of their conflict was not evident in their overt behavior. In fact, in some instances their conflict seemed to serve as a motivating factor in leading them to adopt modes of behavior which would keep them on good terms with other people.

Of equal importance were the "mechanisms" or method which each person must develop for dealing with their conflicts. The methods used by the rejects seemed to be unfortunate choices in most cases, because they were found to be objectionable in the eyes of others. The selects, on the other hand, seemed to have found techniques which were not offensive to others. In Freudian terms, the rejects tended to employ overcompensation, denial, regression, and repression, while the selects tended toward sublimation, rationalization and withdrawal. It was also noted that many of the rejects had developed peculiar mannerisms of speech, gait, and gesture which could often be related to the problem with which they were struggling. The selects, in their behavior, often gave the impression that they had nothing to hide. Their frank verbalizations, open expression, and confident bearing was in general such that persons around them gained a sense of security. It is possible that these different mannerisms of the rejects and selects contributed to some extent to the sociometric standing of each individual since they would make up part of the behavior on which he would be judged.

The TAT

Method

A shortened form of the TAT was used, consisting of the first ten pictures recommended for adult males, and the blank card (Harvard University Press, 3rd Edition). The stories were recorded in shorthand. The TAT was analyzed in the present study primarily by the use of rating scales, and the analysis was directed mainly toward the nature of the relations of the subjects to people and toward society.

Emotional Tone and Outcome

Using the original protocols which had been transcribed from the shorthand, each story was rated for emotional tone and for outcome according to the rating scales provided by Eron (4, Appendix A). A tendency was found for the stories of both groups to be somewhat sad, but the difference between groups was not significant.

The groups were also essentially similar in type of ending they gave to their stories, the difference between mean ratings falling short of significance.

Relationship toward Society

As a general indication of the relationship between the subjects and society, each protocol was examined for stories dealing with crime. For this purpose, only those stories were included where the crime was carried to completion; that is, the murder, suicide, robbery, etc. was actually committed. There were many more stories where a crime theme occurred in the thoughts of the characters, but was not fulfilled in their action. Themes of this type will be discussed in the thematic analysis. It was found that nine

TABLE IV

The Number and Type of Crimes Found in the TAT Stories of Each Group

Crime	Selects	Rejects
Espionage	2	
Assault	3	
Accidental homicide	3	4
Murder	1	4
Suicide	2	2
Robbery	1	6
Unnamed crime	1	3
Confidence game		1

selects and ten rejects told stories where a crime was committed, which is about half of each group (50 and 52 per cent, respectively). Table IV shows the number and types of crimes which occurred in each group.

The table shows that even though an almost equal number of subjects in each group told stories dealing with crime, the number of such stories occurring in the reject group was considerably greater than was found in the selects. If frequency of a certain theme may be regarded as an index of the strength of the drive giving rise to that theme, then this finding may indicate that in these rejects there was a greater tendency toward anti-social behavior, or at least that there was more hostility present in them as a group.

Examination of the table suggests that the stories dealing with crimes seemed to reflect a type of thinking which was quite different in the two groups, and may have had significance for their sociometric standing. In the selects, hostility found a direct outlet in assault against the offender—a solution which never occurred among the rejects. This is behavior which is understandable, overt, and combines a conventional mixture of emotion and action. On the other hand, among the rejects was found more toying with the idea of extreme aggression (murder) for which no logical reason was given, more robbery or just "crime" in a generalized sense, and in one instance the most devious form of aggression, the con-game. It is not proposed that the rejects would always carry out, in overt behavior, the acts about which they fantasied in these stories. But that their thinking followed these lines probably reflects a hostility toward others which in some instances would have been noticeable by persons who had to associate with them. It is also important that in many instances the hostility seemed to be there, but without instigation. It may therefore be presumed that the hostility arose from repressed conflicts and if it found expression at all, it might be displaced onto whomever was nearby. Such hostility arising from a neurotic source is quite different from the aggression evidenced in the stories of assault given by the selects.

Thematic Analysis

The check list of 125 themes provided by Eron (4) was used for the thematic analysis of the TAT protocols. An examination of the predominant themes revealed patterns which logically fit together. Table V presents the 22 themes which were found to be most frequent, or on which the groups differed most widely.

TABLE V

TAT THEMES WHICH WERE MOST FREQUENT AND ON WHICH THE GROUPS DIFFERED MOST WIDELY IN FREQUENCY

Theme	Frequency	
	Selects	Rejects
Parental pressure	31	37
Parental succorrance	13	15
Nurturance to parents	5	0
Departure from parent	6	8
Concern for child	3	7
Death or illness of parent	12	9
Disappointment to parent	1	6
Departure from partner	3	8
Illicit sex	13	9
Aggression to peer	7	4
Death or illness of peer	0	5
Aspiration	16	13
Suicide	4	1
Moral struggle	9	5
Occupational concern	10	20
Physical illness or death of hero	3	7
Compensation	0	6
"Hurt feelings"	0	7
Aggression to environment	6	12
Contentment with partner	8	4
Congeniality with peer	6	3
Self-tranquility	6	1

The selects more often presented themes using the more tender emotions of congeniality, tranquility, offering aid to the parent, and showing contentment with a partner of the opposite sex. When hostility was aroused, they tended to give it direct expression by becoming aggressive toward the object of their dislike. They were concerned over the moral aspects of their behavior. They indicated less inhibition in heterosexual relationships.

The rejects tended more frequently toward passive solutions of their difficulties, such as leaving their parents or their partner, and finding compensatory rewards. They were more easily hurt, and they displaced their hostilities by becoming aggressive toward innocent objects in their environment. They indicated dissatisfaction with their present lot, and seemed to feel that they were a disappointment to their parents.

The most frequent theme of both groups expressed the attitude that their parents were dominating and disapproving.

Summary

1. The purpose of this investigation was to compare the personalities of a group of male college students who had been shown, sociometrically, to be the most unpopular individuals in a men's dormitory with a group who had been found to be the most popular. There were 21 subjects in each group.

2. The techniques used included the MMPI, the Rorschach, and the TAT.

3. Within the limitations of the tests, the results indicate that neither the selects nor rejects were optimally adjusted. The rejects suffered greater anxiety and showed trends toward schizoid and psychopathic deviate patterns. Their methods of defense caused further rejection, and they retaliated by expressing their hostility through devious measures.

4. The selects were more frank and open in their behavior, and tended to give others a sense of security through their direct and understandable reactions in interpersonal relationships. Some of the selects, however, had achieved their popular status by having learned certain behavioral roles, and their adaption of these roles stemmed from a neurotic basis.

5. It is proposed that two factors of primary importance for interpersonal relationships are a) the degree to which conflict or anxiety has pervaded the entire personality structure, and b) the methods adopted by each individual in handling the conflict or defending against anxiety.

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GROUP CHARACTERISTICS OF GOOD AND POOR PERFORMING COMBAT UNITS

DANIEL M. GOODACRE III
Personnel Research Institute, Western Reserve University

The Institute for Research in Human Relations has been engaged in a research project[1] for the past two years to "develop measures of effectiveness for small combat units." An earlier phase of this project involving the use of a sociometric test as one of several predictors of combat unit effectiveness has been reported in SOCIOMETRY (1).

PROBLEM

The problem at hand was twofold. What differences in group characteristics exist between good and poor performing combat units? Can these differences be found by interviewing the group members of good and poor performing units?

METHOD

Criterion. A criterion of field performance for Army rifle squads had been developed as part of the project. The criterion was a six hour, blank-firing problem which called upon the nine-man squad to perform most of the duties found in a "normal" combat situation. Two umpires closely followed the squads on the problem and rated their performance on a standardized rating form. The median umpire-umpire reliability coefficient of these ratings for the rating of 20 randomly selected rifle squads was .88.

Interview Administration. The interview was conducted as a part of a three-day field problem and predictor testing program. The men from 63 rifle squads randomly selected from an Army Infantry Division in this country were the subjects used. The field problem and predictor testing were conducted at the same military reservation. Four squads were run through the criterion field problem each day on two separate problem courses, two squads to a course. No significant differences were found in performance as a function of which course was used for squad testing. Interviewers did not know what squads interviewees were from.

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[1] This research was conducted under contract with the Personnel Research Section of the Adjutant General's Office. All opinions expressed here are those of the writer and are not intended to be represented as having the official sanction of the Personnel Research Section of the Adjutant General's Office or any other U. S. Government agency.

Interviewers. Seven interviewers were used for this phase of the project. The interviewers had academic training in psychology at the M. A. level or better; had had both formal training and practical experience in interviewing; and had a wide acquaintance with the type of population being interviewed, either through military service, research work with the infantry, or both. An informal in-service training program was held for the interviewers after the pre-test of the interview schedule to standardize as much as possible individual frames of reference for judging responses and to insure that all interviewers knew what concepts were to be "tapped" by each question.

Population. The interview population consisted of all the available men from those squads making criterion scores among the highest ranking 13 squads and from the lowest ranking 13 squads. This gave a theoretical N of 234 men—theoretical because about ten per cent of these men were sick, A.W.O.L., sent to schools off the post, or otherwise unavailable when called to be interviewed. Out of the total population 216 men were interviewed.

Description of Interview Schedule. The interview schedule was of a semi-structured nature. Each of the questions was followed by either scoring categories or a rating scale for quantifying the responses. The interview schedule contained sections on Field Problem Interest, Training and Army Experience, and Leadership and Role Expectation, in addition to the section on Group Characteristics with which we are concerned here.

Development of the Interview Schedule. Many hypotheses as to the influence of various group characteristics upon small unit effectiveness had been formed during the two years of previous work on this problem. Some of these hypotheses were being tested in the form of various predictor measures. Other hypotheses that had never been formally stated or tested were to be tried out in the interview to see how fruitful they might be for further research. It was felt necessary to use a conceptual framework within which these hypotheses could be grouped together so that the end result would not just be a collection of accepted or rejected hypotheses. A framework suitable for our needs (although not developed for this purpose) had been previously developed by John Hemphill of Ohio State University.

Hemphill (2) has developed a system for describing what he terms "Group Dimensions." These dimensions consist of relatively independent, characteristics derived on an a priori basis which are thought to describe "a sizeable majority of groups."

Those dimensions not thought to be applicable to our hypotheses as to the nature of small unit performance were discarded. The dimensions which were retained had to meet the two related criteria of heterogeneity and predictability. That is, it had to be reasonable to assume that there would be variability of the dimension from squad to squad and that this variability would be related to the variability in squad performance on the criterion problem. Nine of the original 15 dimensions were retained on this basis. The definitions of these nine dimensions were revised and in some cases extended to tailor them more closely to our needs.

Twenty-four questions were used in the pre-test of the interview schedule to tap these nine dimensions. Each question was built to test one or more hypotheses. After pre-testing the interview schedule, the number of dimensions were reduced to five with 16 questions retained to represent these dimensions. The interview schedule underwent further revision after the first 67 men were interviewed. The group characteristics section of the final form of the interview schedule contained five dimensions tapped by 13 questions which were built to test 16 hypotheses.

These five dimensions, with their somewhat extended and revised definitions, are as follows: 1) Stability: The physical stability in terms of the turn-over rate of group members. 2) Potency; externalized: The value, as perceived by the group members, that is attached to the group by persons outside of the group. Potency; internalized: The importance of the group to the group members. 3) Hedonic Tone and Viscidity: The degree of individual and sub-group harmony and agreeableness within the group. 4) Intimacy; externalized: The extent of the existence of overt acts of friendliness and "closeness" among the group members. Intimacy; internalized: The degree of "warmth" in the thinking and/or feelings of members of the group about each other. 5) Stratification and Control: The hierarchical structure of the group as perceived by the group members together with the concomitant authority implicit in the recognition of this structure.

Results

Seven of the 13 questions produced responses which differentiated between the good and poor performing squads at the .05 level of significance or better. Six of the hypotheses being tested by these questions came out in the predicted direction. The responses to one of the questions which differentiated between the good and poor performing squads resulted in a reversal of the hypothesis being tested. Table I presents these results.

TABLE I

Questions, Hypotheses Tested, and Results of the Questions in Differentiating "Good"

TABLE I

QUESTIONS, HYPOTHESES TESTED, AND RESULTS OF THE QUESTIONS IN DIFFERENTIATING "GOOD" FROM "POOR" SQUADS

Questions Asked	Hypotheses Tested	Results and Levels of Significance
1. *Stability* (a) About how long have you been a member of the squad with which you worked on the field problem?	Those squads having the highest criterion scores will have men in them who have been together in the same squad a significantly greater number of days than will the men in the low scoring squads.	Hypothesis rejected. Not significant by inspection.
2. *Intimacy* (a) What guys in your squad do you usually hang around with on the post during duty hours? For instance, while you're waiting around here to be interviewed, or when you go to the P.X. or chow?	Those squads making the highest scores on the criterion problem will have significantly more men in them who hang around together on the post *during duty hours* than those squads who make the lowest scores on the criterion problem.	Hypothesis rejected ($X^2 = 2.03$; .20 p .10)
(b) How about after duty hours on the post? What guys do you usually go to a show, drink beer or play cards with?	Those squads making the highest scores on the criterion problem will have significantly more men in them who go around together after duty hours than those squads making the lowest scores on the criterion problem.	Hypothesis accepted ($X^2 = 5.07$; .05 p .02*)
(c) What guys in your squad do you usually go on a pass with?	Those squads making the highest scores on the criterion problem will have significantly more men in them who go on pass together than will be found in the lowest scoring squads on the criterion problem.	Hypothesis rejected ($X^2 = 1.47$; .30 p .20)

* Significant beyond the 5% level.

TABLE I (Continued)

QUESTIONS, HYPOTHESES TESTED, AND RESULTS OF THE QUESTIONS IN DIFFERENTIATING "GOOD" FROM "POOR" SQUADS

Questions Asked	Hypotheses Tested	Results and Levels of Significance
3. *Stratification & Control* (a) Trace the general route and major actions of the problem. Say, "Now I want to test your memory to see if you can remember who gave you what orders during the problem. At this point, (at the reconnaissance objective, for example) what orders did you get and from whom?"	The high scoring squads on the criterion problem will have significantly fewer incidents of the formal group structure differing from the functional group structure than will the low scoring squads.	Hypothesis rejected ($X^2 = 13.07$; .001 p .0001**)+
(c) Tell me what man or men you saw the squad leader call to for help or turn to for advice during the field problem.	The high scoring squads on the criterion field problem will have significantly fewer number of incidents of the squad leader asking for help or advice on the field problem than will the low scoring squads.	Hypothesis rejected ($X^2 = 2.16$; .20 p .10)
4. *Hedonic Tone and Viscidity* (a) As compared with other squads how much bitching and griping would you say went on among the guys in your squad during the field problem?	The members of the high scoring squad will report less griping in their squads than will be reported by the members of the low scoring squads.	Hypothesis rejected (not significant by inspection)

** Significant beyond the 1% level.

+ The difference between the high and low scoring squads was not in the predicted direction.

+ The difference between the high and low scoring squads was not in the predicted direction.

TABLE I (Continued)

Questions Asked	Hypotheses Tested	Results and Levels of Significance
(b) Take the names of the men, who, in the intimacy questions appear to be the interviewee's best buddies (or buddy). Write these names and the interviewee's name down as "clique 1". Ask the man something like, "You guys (read the names) buddy around more with each other than anyone else in the squad, don't you?" Then, take the list of names of men in the squad. Go down the list and ask who the first man (not in clique 1) goes around with. If this man isn't an isolate build clique 2 around him. Continue this procedure until all names have been asked.	♯1—There will be more isolates reported among the members of the low scoring squads than in the high scoring squads.	Hypothesis rejected ($X^2 = 2.69$; .20 p .10)
	♯2—There will be fewer cliques reported among the high scoring squads than among the low scoring squads.	Hypothesis rejected ($X^2 = .82$; .40 p .30)

TABLE I (Continued)

QUESTIONS, HYPOTHESES TESTED, AND RESULTS OF THE QUESTIONS IN DIFFERENTIATING "GOOD" FROM "POOR" SQUADS

Questions Asked	Hypotheses Tested	Results and Levels of Significance
(d) Who are the men in your squad that you don't get along with too well, and who you'd just as soon not have around where you are?	There will be more men reported in the low scoring squads with whom other squad members "don't get along with too well" than in the high scoring squads.	Hypothesis rejected ($X^2 = .14$; $p = .70$)
(f) The squad leader is *not* asked this question. Interviewer briefly reviews the field problem with the interviewee and then asks: "How would you have run that phase (of the field problem) if you had been the squad leader? Would you have taken the same route your squad leader did? (Wait for answer) How about when the squad got fired on, would you have sent the AR around like your squad leader did? — etc."	There will be significantly fewer disagreements with how the squad leader ran the problem reported by the men in the high scoring squads than reported by the men in the low scoring squads.	Hypothesis accepted ($X^2 = 4.11$; .02 p .01*)

* Significant beyond the 5% level.

TABLE I (Continued)

Questions Asked	Hypotheses Tested	Results and Levels of Significance
(g) Let's say that you are now the company commander of your company. All the rest of the men in the company are now privates. You are Capt ——— (the man's last name) and you are also a private in the squad you are in now. You are going to rebuild the squad you worked with on the field problem to make it the best field squad you can. You can use any of the men who have been in the company during the past six months, including yourself. Who would you make squad leader? Who would you use as A.R. man? Asst. A.R. man? Riflemen?	#1—Men who are members of high scoring squads will place members of their own squads in the same position in the rebuilt squad as those which were held in the squad which performed in the field. Members of low scoring squads will place fewer of the men from their squads in the same position in the rebuilt squad.	Hypothesis accepted ("t" = 4.43; .01 p .001**)++
	#2—There will be a significantly greater number of men from the high scoring squads placed in the rebuilt squad but *not* in the same position as previously held than will be found among the men in the low scoring squad.	Hypothesis accepted ("t" = 2.60; .01 p .001**)++

++ For the "t's", the degrees of freedom used were infinity. (EDITOR'S NOTE: While some investigators might require more rigorous accounting of degrees of freedom, i.e. # of squads, the direction of difference is the matter of obvious importance here. E.F.B.).

** Significant beyond the 1% level.

TABLE I (Continued)

Questions Asked	Hypotheses Tested	Results and Levels of Significance
(g) Continued—	#3—There will be a significantly greater total number of men from the high scoring squads placed in the rebuilt squad than will be placed in the rebuilt squad by the men of low scoring squads.	Hypothesis accepted ("t" = 2.48; .02 p .01*)++
5. *Potency* (Internalized) How proud are you to be in the squad you're in? (the squad you worked with on the field problem).	The high scoring squad will have a significantly greater average amount of expression of pride in their squads by their men than will be found among the men in the low scoring squads.	Hypothesis accepted ("t" = 3.40; .01 p .001**)++
(Externalized) How many of the guys in the other rifle squads of your company do you think would like to be in the squad you were in during the field problem?	There will be a significantly greater number of men in the high scoring squads reporting a greater number of men as wanting to get in their squads than will be reported among the men in the low scoring squads.	Hypothesis accepted ("t" = 2.37; .02 p .01*)++

* Significant beyond the 5% level.

** Significant beyond the 1% level.

++ For the "t's", the degrees of freedom used were infinity. (EDITOR'S NOTE: While some investigators might require more rigorous accounting of degrees of freedom, i.e. # of squads, the direction of difference is the matter of obvious importance here. E.F.B.).

Discussion

One interview question (Stratification and Control—a) produced especially interesting results. This question was asked as follows: "Now I want to test your memory to see if you can remember who gave you what orders during the problem. At this point (reconnaissance objective for example) what orders did you get and from whom?" The interviewer traced the general route the problem followed with the interviewee on a diagram of the course while asking him this question at all major points of action. The interviewee was led to believe that this question was a test of his memory. When a similar question was asked in the pre-test without being presented as a memory test quite a lot of resistance was met. It seems that the interviewees thought that it was not "good" for men to give orders when not authorized to do so, and were therefore reluctant to "squeal on their buddies." A note to the interviewer explained that only those responses where incidents of assumed undelegated authority were involved were to be recorded. The hypothesis was that men in squads making high criterion scores would report fewer incidents of differences between the formal and functional group structure of their squads than would the men in the low scoring squads. The assumption being the more frequently orders were given as prescribed by the formal structure of the military (i.e., via "chain of command"), the less the degree of dissension that would arise, resulting in greater unit effectiveness. The results indicate that as applied to our data this hypothesis is false. There was a significantly greater amount of assumed undelegated order giving reported among the "good" squads than among the "poor" squads.

Admittedly, this evidence is tenuous grounds for any generalization, but we would like to offer one. These results may indicate that the stronger the goal orientation shared by squad members towards successful completion of the problem, the more undelegated authority was assumed and the more tolerant fellow squad members were of accepting and carrying out these orders. Thus, squads whose members were not strongly goal oriented would have members who were both less tolerant of accepting assumed undelegated authority from others and less willing to assume it themselves. It is hypothesized that the need to achieve the goal becomes for the highly goal oriented groups dominant over the need to conform to the learned pattern of following "chain of command." These conjectures rest on the assumption that no significant differences in individual proficiency existed between the high and low groups. The only evidence for this is that no significant

differences were found between high and low groups on AGCT scores or length of time in the Army.

It is interesting to note that of the three near-sociometric questions Intimacy "a," "b" and "c" only one, "b", produced significant results. This discrepancy in results is believed to have been due to the failure on our part to account for certain factors in the particular social situation. In the question concerning the men with whom the interviewee usually interacted during duty hours (Intimacy "a") we failed to recognize the restriction of choices imposed by the nature of the during duty hours activities. It was later found that the extent of off the post interactions (Intimacy "c") also had a restriction imposed upon them in the form of marital status and geographical location of off the post housing. About 40% of the men were married and lived in nearby towns. These men tended to go off the post with those who lived near them—not out of preference but for convenience. The question of these three which did significantly differentiate good from poor squads (Intimacy "b") was subjected to less of these restrictions due to artifacts in the situation and thus revealed more meaningful choice behavior. We believe that the fewer the restrictions placed upon sociometric questions by artifacts in the situation, the more truly representative will be the expression of tele which is obtained.

Many hypotheses which appeared fruitful had to go untested due to difficulty in interviewee-interviewer communication. Three factors contributed to this problem. First, in many cases the interviewees appeared to lack the social sensitivity necessary to recognize the existence of such processes and structures as group mores, group goals, or cleavage within their squads. Second, it was difficult to find words which could communicate such concepts in terms understandable to the interviewee without losing the essence of the concept. Third, even in cases where the interviewee had probably been exposed to the concept under investigation, and recognized its existence in the raw behavioral form, he often could not communicate the fact of its existence due to his generally below average mental ability-verbal facility.

Summary

The problem was to find out what differences in group characteristics exist between good and poor performing rifle squads. The criterion consisted of ratings of squad performance on a six hour maneuver-type blank firing field problem. Two hundred and sixteen men from the highest ranking 13 squads and the lowest ranking 13 squads on the criterion problem

were interviewed. Thirteen questions were evolved from a larger pool of questions after pre-testing the interview schedule. The 13 questions retained were built to test 16 hypotheses. Eight of these 16 hypotheses were accepted as tenable with chi square or "t" values above the .05 level of significance.

Stratification and Control, Hedonic Tone and Viscidity, Intimacy, and Potency proved to be the four most fruitful group dimensions for differentiating good from poor performing small combat units.

Briefly, it was found that the turn over rate of group membership was not significantly different in the poor performing squads from that in the squads which performed well. The men in squads making high scores on the criterion problem reported a significantly greater number of men in their squads "buddying around" together on the post after duty hours and taking the initiative to give orders to other men during the problem without the authority to do so. The men in the high scoring squads also reported fewer disagreements with how their squad leader ran the problem; more satisfaction with the present positions held by the men in their squads; more pride in their squad; and the feeling that their squad is one in which more men would like to be.

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A DIMENSIONAL THEORY OF SOCIAL DIFFUSION

An Analysis, Modeling, and Partial Testing of One-Way Interacting

STUART C. DODD AND HENRY WINTHROP
Washington Public Opinion Laboratory, Seattle

I. THE FIELD OF DIFFUSION THEORY

This theory of social diffusion attempts to deal mathematically with one of the basic problems of social psychology and sociology, namely: How does novel behavior, once it occurs in at least one person, diffuse through a given population, particularly when its chief means of spread is by person-to-person interaction? Novel behavior means a response or activity, including the learning of information, which has not appeared before in that population in the current specific form and which may exist in any sensory modality. Behavior diffuses (or "is imitated" we often say) under various types of social constraint, with resulting diverse forms of distribution of the acts in time and distribution of the acts among people. Each of these constraints is translatable into quantitative terms.

Diffusion has been an area of interest to anthropologists studying the spread of culture. How does a new culture trait grow in time through a homogeneous population starting with its innovators and ending up as a trait of everyone? A theory of diffusion charts the growth curves of culture. Diffusion has been an area of special interest to sociometrists studying the development of networks (15). How does an interperson network of friendships arise, grow, or decline? How do opinions and rumors spread? A theory of diffusion should show the mechanism, explaining such sociometric networks of communication. From this has developed an interest in social psychology for studying rumor or the communicating of any news item. How fast does a rumor spread under specifiable conditions? A theory of diffusion should predict the temporal course of a rumor or other news item as it converts non-knowers into knowers.

Any scientific theory of that kind of novel social behavior which diffuses on an atomistic or person-to-person basis, if it is to serve the predicting function of science, must fulfill two basic objectives. (1) The theory must develop theoretical models which weave any number of the many types of conditions or constraints which govern diffusion into a homogeneous mathematical warp and woof. These conditions will often be expressed mathematically as parameters in the equations, i.e., as constants related to variables.

The models must thus be internally consistent, systematizing new knowledge with current knowledge. (2) The theory must comprise models whose concepts can be operationally defined and whose parameters and variables can be determined by ordinary statistical procedures. The models must thus correspond to external reality, yielding close and good fits to observed data. These two objectives are the time-honored tests of truth in science—the consistency test using deduction largely and the correspondence-to-phenomena test using induction largely.

Our theory of social diffusion can be stated in capsule form as "the dimensional analysis outlined below will improve the predicting of diffusion, and improve predicting more than analyses in other terms."

More exactly, the theory asserts the set of testable propositions that:
Prediction of diffusion will be improved to the extent that

a. its chief factors, such as the dimensions, called "interactors," "acts," "time," "space"
b. are measured with high precision, validity, and reliability
c. and have their intercorrelations computed with each other
d. and with systematic models which hypothesize uniformities in the phenomena under specified conditions.

Our theory of diffusion will be stated in more detail in models (Refs. 6, 8, 9, 10, 20, 21) since these specify not only the variables, the constants, and their relations but also the social pre-conditions (or assumptions mathematically) and the procedures for verifying both the assumptions and eventually the whole theory. Each model specifies an hypothesis under specified conditions; the full set of consistent hypotheses which are only outlined here constitutes our complete theory of social diffusion.

Our theory is a predictive one in that the test of it is: How well will it predict diffusion in new situations in the future? The focus of attention will always be the quantitative process of diffusing, seeking to answer the question "How many individuals will exhibit the new behavior (which is at issue) at any given time?" This quantitative analysis builds on prior qualitative analysis, of course. The qualitative analysis, which is here the first stage of our dimensional analysis, seeks to classify the phenomena of diffusing into subclasses whose behavior is so homogeneous and stable relative to the predict and that the predictions about any member of one subclass will be excellent.

II. An Analysis of Diffusion

A. Analysis into dimensional factors

Social diffusion is here defined as *the growth and spread, from person to person, of a one-way change of behavior.* The diffusing behavior, or novel act, appears at least once and cumulates in more and more people in a larger area as time goes on. This definition implies that diffusing is a product (not a sum!) of at least six factors, namely, the *actors* and *reactors,* their *acts,* the *timing, spacing,* and other factor *conditions.* Thus in the interact, which may be diffusing a rumor, the factors are the tellers and hearers, the act of telling, together with its temporal, spatial and other factor conditions such as the intensity, frequency and recency of the stimulus, etc. This product* of the six factors is a change of *interaction* of people—the one-way or transitive case (from diffusers to diffusees) of some new item of behavior.

In contrast to the factors or *dimensions* of diffusing, the remaining variables correlated with the diffusing are addends which we usually call the additive or alternative *conditions* of diffusing. All the conditions, whether factors or addends, may be usefully subclassified by tense of time as:

1. pre-conditions—including all causes;
2. co-conditions—including all concurrent variables if correlated to the diffusing;
3. post-conditions—including all consequences.

The theory outlined here does not discuss the past and future conditions of diffusing phenomena, and is an incomplete presentation to that extent. For we see a complete theory as systematizing operationally defined variables related together in all three tenses. Since this diffusion theory is a dimensional one, it explores first how large a part of diffusing can be explained and predicted from knowledge of the six basic factors, or dimensions, in the present tense, before going on to explore what residual past or future conditions one also needs to know in order to improve predicting the diffusion still more exactly.

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* This product takes care of some of the old objection that "a whole is more than the sum of its parts." The logical, mathematical, and social test of a variable being a factor is whether the product vanishes when the factor is absent, i.e., becomes zero in amount. Thus there can be no diffusion if there is no diffuser, or diffusee, or no time involved, etc. The empirical test of this "factor hypotheses" is whether the multiple correlation of the logs of the variables will predict observed diffusing better than the raw variables (It has regularly done so in the situations tested to date.)

1. Acts, A. The first factor in any diffusing is an act, some novel behavior, whether telling a new rumor, reading a news item, buying a new product, following a new fashion, adapting imitatively to any new situation, educating children, acculturating immigrants, or any other subclass of new acts. We study and test all-or-none acts in populations of 100 to 1,000 persons at first, for simplicity. Later, the theory can be readily extended to include acts in degrees, or in series, or in combinations of any desired complexity. Often the acts and reacts of actors and their reactors need to be distinguished, as when a telling of a rumor may not be equivalent to a hearing of it.

The most basic compound unit with the act as a factor is the "potency" of diffusing. It is the per capita activity defined as the acts-per-actor-ratio. $[AP^{-1}]$ In communicational diffusion, wherever one act converts the non-knower to being a knower, the potency is the hearers-per-teller ratio. If this ratio is high it measures a potent telling or diffusing act which will tend to spread far, fast, and fully. A potency above unity means a waxing diffusion; a potency below unity means a waning diffusion; a potency of 1 means "maintenance" diffusion.

2. Actors and reactors, P_I, P_{II}. A second factor in the diffusion product is the number of people, P, involved, either as diffusers or diffusees. This population factor could appear at any of four levels according as its power or exponent is 0, 1, 2, or 3.* Thus $[P^0]$ denotes a person; $[P^1]$ denotes a plurel, a sum of persons, the actors; $[P^2]$ denotes a group, a product of acting and reacting persons, i.e., interactors; and $[P^3]$ denotes an organization, a power or triple product of acting, reacting, and role-acting persons. (See Ref. 7) Each of these levels will modify the diffusing process. Thus we have found that exponential curves predict well the diffusing from mass media in plurels, while logistic curves predict better the diffusing within a group—just as their two dimensional formulas expect. In this paper we sketch only sample cases of diffusing in a homogeneous or

* The square brackets denote dimensional formulas which relate classes of magnitudes together irrespective of the statistical indices, units, or origin points in terms of which the magnitudes may be expressed. They thus transcend statistical minutiae in order to interrelate highly abstract concepts with rigor. The necessary further specifying of indices, units, and origins which converts dimensional formulas into statistical formulas is done respectively by the three corner scripts other than the exponent in our S-notation, namely: origins $= {}_{s}{}^{\times}{}_{s}$, units $= {}_{s}{}^{}{}_{s} =$ indices

unorganized group, the [P^2] case, where the act spreads from person to person. Such diffusing may be constrained by various forms of group structure of which sample structures (e.g. "iadic," partly "iadic," and "ramified") are sketched below.

3. Time, T. The time dimension in diffusion appears in different forms depending on the origins, units and operations one uses. Using fixed origins yields *dates* in "public time"; while individual origins yield *ages* in "private time"; and using any current moment as zero point yields the past, present and future *tenses* of time.

Using clock or cardinal time units yields durations. Sequences, or ordinal units of time, measure repetitions, removes of retellings from "first-hand" to "n-th hand", as well as all familiar earlier-later sequences as in the concepts of "cause and effect," "stimulus and response," "means and ends," "action and reaction," etc.

Ordinal time units may be highly useful for transcending daily and other cycles that often obscure diffusion trends when stated in cardinal time units. Our experiments using a "random net" model and ordinal units can predict the time course and the outcome of diffusion better than we can do as yet with cardinal units.

These different manifestations of time dimension when multiplied by the activity dimension yield "periodicity," or statistical time series, which are distributions of the acts in time. Some of the diffusion models involving "rectangular," "concurrent," or "serial" periodicity will be sketched below.

4. Space L. Another dimension of diffusion phenomena is space, subclassified into dimensional "levels" as points, distances or lengths, areas, and volumes. In diffusing, space acts as resistance, requiring more effort from diffusers to overcome it the longer the intervening distance to diffusees. Consequently, distance appears in the denominator or with a negative exponent [L^{-1}]. Our studies and those of J. Q. Stewart, G. K. Zipf, and others tend to show, both from empirical data and from geometric deductions, that spatial diffusion decreases harmonically, i.e., with the first power of the distance traversed. We have twenty-seven sets of diverse data (Ref. 1) in which the mean fitted exponent on the distance factor was minus unity. The space factor in diffusing will not be sketched further in this paper, however.

5. Factor conditions, C^c_c. Residual factors—which are themselves a product of many subfactors—are those of the co-conditions which behave

multiplicatively and not additively. This class of factors includes all the residual constraints on diffusing (other than constraints expressible in terms of acts and actors, time and space). This residual class may include any relevant variables whatever, whether attitudinal or ecological, whether cultural or physical, whether semantic or methodological or teleological. This is the huge field for research, always beckoning, whose size is measured by the multiple coefficient of non-determination ($k^2 = 1 - r^2$), remaining after the previously discussed factors have been used as predictors. Again, we will omit further discussion of the many co-conditions of diffusing in this paper, since we have chosen to study the basic social dimensions of time, space, people, and their activity first.

The factors of diffusion above may now be brought together in a summarizing formula, which in turn is but a special case of our still more comprehensive dimensional theory.

Our diffusion theory describes and predicts the forms and amounts and relations of "new actors and reactors acting and reacting, under specified temporal, spatial, and other conditions." In dimensional symbols, diffusing is but a special new or one-way case of human interacting:

$$[I_{pp} = A^2\ P^2\ T^{-2}\ L^{-1}\ C^0] \qquad \text{Eq. 1}$$

This equation defines the interactance, I_{pp}, as a product of powers of at least this set of factors (A = acts, P = people, T = time, L = length, C = any set of factor conditions). The interactance hypothesis, of which diffusion is a special case, expects the interactance thus defined to correlate highly with, and so to predict, the observed interacting or diffusing. This hypothesis will be confirmed in any situation in which the closeness of fit index of correlation between expected and observed data exceeds .9 in uncumulated data (and exceeds .99 in cumulated data), provided that the goodness of fit or reliability from sampling is acceptable at the 5% confidence level.

The interactance may be expressed in "unit form" as "one actor stimulates by unit act one reactor, to unit response, in unit time, across unit distance, under unit conditions." (This means that standardizing the units, such as in our potency ratio, is a prerequisite to research.) The interactance may be paraphrased further in interrogative form as: Who?, does what?, to whom?, where?, when?, how?, and why? More specifically for diffusion, the formula should help to answer such questions as: How fully through the population will the novel behavior spread? How far? How fast? How faultily? Under what facilitating conditions? etc.

This diffusion formula, Eq. 1, in dimensional form, expects, as hypotheses:

a. this set of factors to predict diffusing better than other sets;
b. their multiplicative combination to predict best;
c. their weighting by exponents to improve prediction further;
d. the statistical indices, units and origins (which are specified by scripts at the three remaining corners of each base letter in our standardized matrix script notation and which are not specified in a dimensional formula) to be further operationally defined in any given research.

This diffusion formula, when in statistical form with exponents and other parameters stated in numbers, should predict the amount as well as the form of the course and outcome of a given diffusing process from knowledge of its start or preconditions. Thus, given the starting potency, and the experimental observation that the potency waned harmonically with removes, the random net model, developed by Professor Anatol Rapoport, has successfully fitted ($r = .99$ in uncumulated data) the waning course and final proportion of the population reached in a case of diffusion (which was measured while the diffusion was still waxing).

B. *Analysis of the timing and grouping factors.**

There are many kinds of conditions expressible in mathematical parameters available, from which a choice can be made for priority of study in order to develop a consistent set of models for a theory of diffusion. Out of the total set available we have chosen to illustrate here some *timing* and some *grouping* factors ($[T^{-2}]$ and $[P^2]$ dimensionally): These are (1) the manner in which any individual's contacts with his acquaintances vary with periodicity in public time; (2) the extent to which an individual experiences repetitious contacts with acquaintances, varying in ordinal time units from a private time origin; and (3) the acquaintance structure (i.e., interrelations or grouping by some criterion) within any given population.

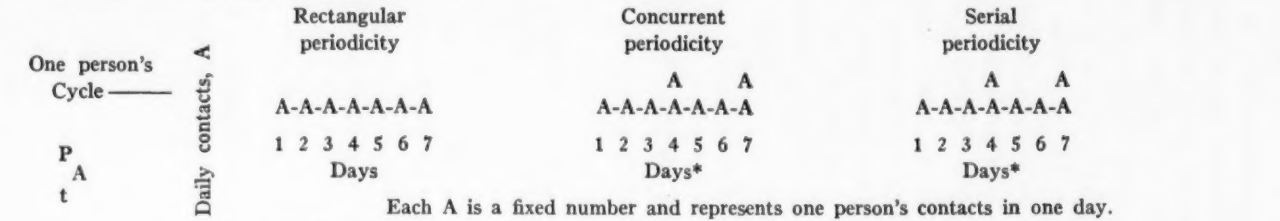
* This section on timing and grouping factors develops special cases of the general dimensional theory of diffusion. Both general and special parts of our diffusion theory are only sketched in this paper and more fully developed elsewhere. See Refs. 1, 2, for Dodd's dimensional analysis and Ref. 4 for his interactance hypothesis which subsumes diffusion. See Ref. 20 for Winthrop's extensive treatment of his eighteen basic diffusion models dealing with periodicity, repetitions, and group structures. The treatment of these eighteen cases constitutes a minor part of the mathematical manuscript of 370 pages which may be obtained for research purposes in mimeographed form from the Washington Public Opinion Laboratory.

With respect to the first of these, we assume that there may be a *periodicity* about the number of contacts an individual makes with his acquaintances, a periodicity which may be governed by such considerations as the hourly rhythms of the work day, calendar week, or any other socially imposed artifact. Periodicity in turn may be classified into three types: rectangular, concurrent or serial periodicity. (See Figure 1.) In rectangular periodicity (which is really a-periodicity) the contacts any individual makes per unit time are constant. In concurrent periodicity the number of contacts any person makes over time changes from period to period, and this number is uniform for all members of any given population, at any given time. The cycle is constant and concurrent for the group, but each person enters the cycle at his own date. In serial periodicity every individual also possesses a variable number of contacts with time, but unlike the situation with concurrent periodicity, not all individuals at any given date are at the same phase of their cycle. Thus every time an individual is converted to new or novel behavior he starts his own conversion cycle at its initial phase, although the date at which such converting takes place may have any value whatsoever.

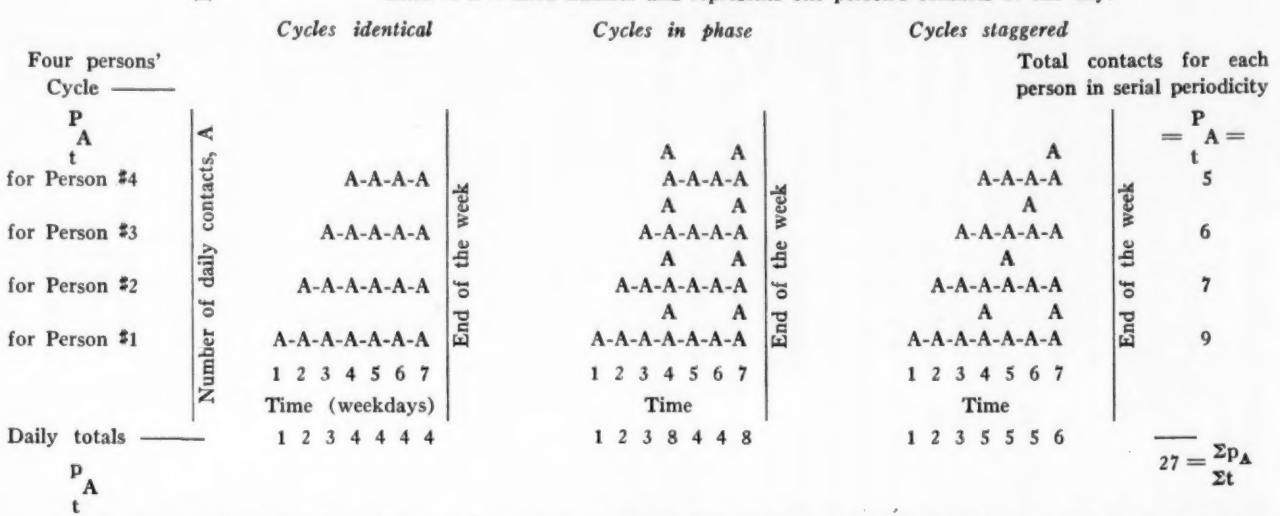
Visually these three types of periodicity may be presented in the following fashion:

FIGURE 1
PERIODICITIES

Three types of a person's daily activity in a weekly cycle are shown.
Activity, ${}_t\mathrm{A}$, is the number of acts by one person in each day and is also the number of new daily converts (if one act converts).
Cycles of activity are the same for all persons though differing in phase. Each person's cycle starts when he is converted but all cycles end together.



Each A is a fixed number and represents one person's contacts in one day.



* The sample cycle shown here shows that two sets of persons met on Wednesday and Saturday and one set on each other day of the week.

Formulas in script notation: A = an act
${}_t\mathrm{A}$ = acts in each of t periods, the 7 week days here.

p_A = one person's act.
$\Sigma_t \mathrm{p}_\mathrm{A}$ = the sum of the acts of p persons each on any of t days.

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Turning from periodicity, consider next another aspect of the time dimension which appears in the form of repetitions of the interact.

Repetitions are basically of two kinds. These are (1) repetitions with one's own converts, either in the same or in different time periods, and (2) repetitions with other men's converts, either in the same or at different time units. Most generally, both of these types of repetition take place in diffusion. The exact specifying of some of the possibilities of repetition is illustrated in the matrices of Fig. 2.

In Fig. 2A the actors (such as tellers of a rumor) are listed as row headings and the same population is again listed as actees (such as hearers) in each column heading. Each cell entry in this repetition net or sociomatrix records the number of times the row person told the message to the column person. The overtellings as well as "first tellings" are thus recorded here. The arrays are arranged to make successive sections of the matrix show the details of diffusing in successive removes or retellings. Each section, or band of arrays, represents a generation of interactors from first hand hearers at the left and top to nth hand hearers at the right and bottom. The characteristic pattern of this repetition net, arranged by generations, is that all cell entries below the main diagonal are zeros and the non-zero cell entries above the diagonal are "stepped", going "downstairs" to the right.

This "step" pattern is even more visible in the chain net, Fig. 2B. Here each teller tells only one person ever, so all the cell entries occur in one diagonal array (just above the main diagonal representing self-relations) whenever the actors or arrays are arranged in order of their removes from the starters. This Fig. 2B shows a ramified structure with unit activity rate or "unit potency ever." This means each teller tells one and only one hearer. This forms a geometric series in which the rate of growth is exactly unity so each generation just maintains its size in the next generation. The cell entries in Fig. 2B are shown recording the dates when tellers told hearers. The cell entries may show other nets, of course, such as when they record the amount of the interact between the two row and column persons, or show any other pair-property in each cell.

FIGURE 2

MATRICES OF SEQUENTIAL INTERACTING

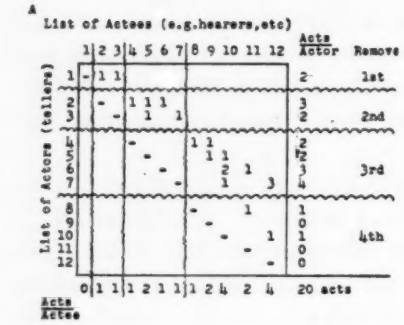


Fig. 2A *A Repetition and Generation Net*
measuring multiple tellings and hearings by generations or removes
cell entry—number of tellings by one teller to one hearer
Row sum = number of tellings by one teller
Column sum = number of tellings to one hearer
Sections (e.g. sets of arrays) = generations on removes in sequence
Note the pattern:
Entries in upper right triangle only
Entries in main diagonal sections denote intra-generation acts
All other entries must be in diagonal sections just above the main diagonal.

Matrix formula $t:p:q \quad {}_{u}A$

which asserts at each of t removes, each of p persons acts on a subset of q persons u times. (p, q, and u are variables)

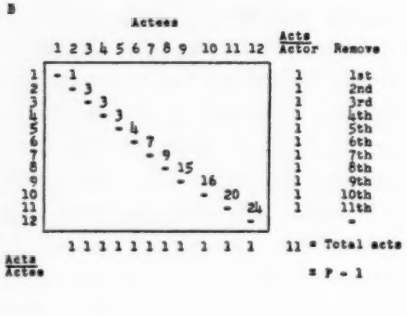


Fig. 2B *A Chain Net* (*with Dates*)
a ramified structure
showing "unit potency ever" i.e., one hearer-per-teller only—with the date (day of month) as entries here.
This is a geometric series with a growth rate of unity.
Cell entries may be used to record:
a) amounts of the interact
b) the date of the interact (as here)
c) repetitions
d) an attribute of the interact or of the pair of interactors, etc.
Note pattern of diagonal entries just above main diagonal
Matrix formula = $P:Q:R\ldots:Z_A$
which asserts "a person acts on another person who acts on another person, etc., to the Z-th person."

Next, in sub-classifying a group by its structure, one must always specify the criterion of structure, that is, the particular variable that is observed and entered in the cells of the matrix in Figure 3 and which records the ties of one kind between the members of the group in all possible pairs. The pattern of these ties, the filled out matrix, specifies the structure of the group *by criterion* C_1 (or C_2, C_3, etc.). For purposes

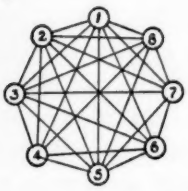
FIGURE 3

SOME GROUP STRUCTURES

In diagram form *In matrix form*

"Iadic" structure—fully interrelated

A



A group of persons all tied together (as shown by connecting lines)

$$\frac{\text{Possible ties}}{\text{Actual ties}} = \text{index of "iadicity"} = 1.0 \text{ here}$$

B

List of actees, e.g., known persons, etc.

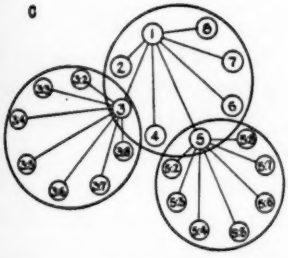
List of actors, e.g., knowers, etc.

	1	2	3	4	5	6	7	8
1	-	1	1	1	1	1	1	1
2	1	-	1	1	1	1	1	1
3	1	1	-	1	1	1	1	1
4	1	1	1	-	1	1	1	1
5	1	1	1	1	-	1	1	1
6	1	1	1	1	1	-	1	1
7	1	1	1	1	1	1	-	1
8	1	1	1	1	1	1	1	-

A 1 in a cell means the row person acts on the column person; a 0 in a cell means he does not act on the column person. Matrix formula = $p:pI$ which asserts "for every pair of persons there is an index of one way interrelation, I".

Ramified Structure—branchingly interrelated

C



None of an actor's actees act on each other, e.g., all of each person's friends are strangers to each other.

D

List of actees

List of actors

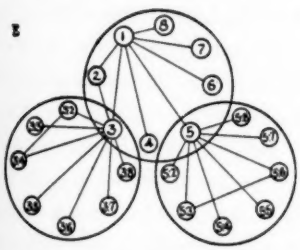
	1	2	3	5 5:2	
1	-	1	1	0 0 0	1 0
2	0	-	0	0 0 0	0 0
3	0	0	-	1 1 1	0 0
3:2	0	0	0	- 0 0	0 0
3:3	0	0	0	0 - 0	0 0
3:4	0	0	0	0 0 -	0 0
5	0	0	0	0 0 0	- 1
5:2	0	0	0	0 0 0	0 -

denoting omitted arrays

The same branching structure arrayed in a matrix for systematic and mathematical treatment. Note pattern of "steps" in upper triangle. Matrix formula = $p:qI$ which asserts "for every person as actor there is a different set of actees, (including any zero set)."

Partially Ramified and Partially Iadic structure—partly interrelated

E



A branching structure overlaid with incomplete tying of the members in each circle or branch.

F

List of actees

List of actors

	1	2	3	5 5:2	
1	-	1	1	0 0 0	1 0
2	1	-	1	0 0 0	0 0
3:2	1	1	-	1 1 1	0 0
3:3	0	0	1	- 0 1	0 0
3:4	0	0	1	0 - 1	0 0
5	0	0	1	1 1 -	0 0
5:2	1	0	0	0 0 0	- 1
	0	0	0	0 0 0	1 -

denoting omitted arrays

The same structure arrayed in a matrix, cross-classifying all possible members of any grouping studied. Matrix formula $p:qI$ which asserts "each person is interrelated to his own subset, q, of any other persons."

of predicting diffusion, relevant criteria may be such variables as (1) acquaintance (e.g., "List your friends here"); or (2) frequency of contact (e.g., "Whom did you talk with yesterday?"); or (3) congeniality of interest (e.g., "Who do you think would like to do, or share, this sort of thing with you?"); etc. In trying to predict diffusion from group structure or sociometric networks, it is necessary that the criteria be independently observable before the diffusing and that the criteria act with full constraint upon the diffusing. Full constraint means that a criterion network (i.e., the matrix entries) are perfectly correlated with the diffusion network. Thus for example, diffusing would go *only* through acquaintances, or *only* through frequent contacters, etc. Of course, in practice this perfect correlation which is assumed by a model does not hold. This, however, is precisely the problem of modeling—to find out experimentally to what degree such assumptions hold and how the model must be revised to reduce discrepancies between its expectations and the observations (if made under appropriately controlled conditions).

The structure of a group by any criterion is sub-classifiable in many way, of which only three types will be noted here. Population structures will be called *completely "iadic," completely "ramified,"* or *partially both.* When each individual of a population possesses a circle of acquaintances no two of whom know one another, the population is said to be completely ramified by virtue of the fact that if, in such a population, each individual contacts and converts a certain number of other individuals per unit time to the novel behavior, the diagram of the conversion or diffusion process over time would show a branching or ramified structure, as in Figure 3, C and D. On the other hand, in a population of i persons all of whom, for one criterion, knew each of the remaining i-1 persons, one might speak of the plane polygon which would represent this acquaintance structure as an i-ad, and one might speak of the population which possesses this property of all-round, mutual acquaintanceship as being completely iadic in nature, as in Figure 3, A and B. Between these extremes are populations in which every individual possesses a circle of acquaintanceship some of whose members know one another and some do not. Such a population would be partially iadic and partially ramified in nature, as shown in Figure 3, E and F. The degree to which any population is iadic is in part a function of the number of pairs of one's acquaintances who are likewise acquainted with each other. This degree of amicability of a population is referred to as the iadicity of the population and may be measured by an index of iadicity.

This index in general is the ratio of the actual ties (i.e., non-zero cell entries in the matrix) to all possible ties in the group of a person's acquaintances including himself.

By combining our parameters for periodicity and for group structure with the dichotomous possibility that an individual (1) may never meet converts (either his own or other people's) over the course of time or (2) will meet converts (either his own or other people's) over the course of time, there results what may be called the 18 basic cases for the timing and grouping aspects of diffusion. These cases spell out some of the possible models in the dimensional classes of "celerations" and of "groups" defined by the formulas $[T^{-2}]$ and $[P^2]$.

These eighteen cases may be tabled here to suggest the present degree of development of this theory of social diffusion. The mathematical exposition of these eighteen types has been developed by the junior author in a 370 page manuscript (Reference 21). Only one type, "Case 11," can be briefly sketched here with two preliminary experiments exploring its applicability.

TABLE 1

CASES OF DIFFUSION CLASSIFIED BY PERIODICITY, REPETITION, AND GROUP STRUCTURE

Structure	Periodicity (No repetitions)		
	Rectangular	Serial	Concurrent
Ramified	Case 1, 10*	Case 4, 13*	Case 7, 16*
Iadic	Case 2, 11*	Case 5, 14*	Case 8, 17*
Mixed	Case 3, 12*	Case 6, 15*	Case 9, 18*

Repetition is allowed in the starred cases (10 to 18) but not in the others. These cases constitute a *first approximation*. By then introducing any number of other parameters into any one of these structures, whether the parameters are psychological, sociological, economic, neurological, etc., one can alter the mathematical models obtained in the first approximation so as to have them conform more and more closely to any degree of socio-psychological reality in which one may be interested.*

* The reader who is interested in the mathematical analysis of these 18 cases or in the mathematical analysis of various socio-psychological aspects of diffusion not dealt with in these eighteen cases, may obtain copies of these by writing to the Washington Public Opinion Laboratory.

C. *Methodological tools for analysis*

There are at least three different but complementary approaches or symbolic devices for representing the growth of new behavior in any given population. These are (1) analysis in terms of the infinitesimal calculus, (2) analysis in finite difference terms which, in turn, divides into analysis in terms of combinatorial algebra and analysis in terms of increment-schemas, and (3) analysis in terms of matrices. Each of these will be described briefly, since the operations they specify are part of the operational definition of this theory of diffusion.

1. Finite differences and infinitesimal calculus

All growth of novel social behavior will be essentially of one of two types of distribution in time. Either the growth of converts to new behavior will be continuous streaming process in time or will exhibit a regular or irregular cyclicity, that is to say, will show "bunching" at certain points in time with negligible growth between these points of "bunching." Where the growth of such behavior is "bunched," finite difference techniques applied to the analytic formulation of theoretical models for the study of social diffusion may be appropriate. "Bunching" may also arise from regular fluctuations which occur within every time interval of growth or from different types of fluctuations within each interval, all of which, however, may be accounted for by some common rationale. If continuous streaming is present, the use of the infinitesimal calculus and probability theory is called for. In any event, discrete (discontinuous) formulations of growth in finite difference terms are *nearly always* directly translatable into continuous formulations and models especially for large populations, etc. At present we believe the calculus may be the better tool for populations which are large and whose relevant structuring in detail is unknown; while finite differences may be the better tool for small groups whose relevant structuring can be measured. Further experimentation is needed to chart the conditions under which either the finite or infinitesimal difference models are likely to predict diffusion best under given conditons. In this paper illustrations of diffusion technics and experiments will be limited to the finite differences technic which the junior author has developed extensively.

2. Increment schemas

A second semantic tool for studying diffusion is the increment schema. This schema tabulates the converts by their converters and by their generations or removes from the start. It cross-classifies the knowers or converts

to the novel behavior by their ancestry and by their generation in the series schema, i.e., it subclassifies converts along the population and time dimensions.

An increment schema arrays the diffusion data by "generations" in successive rows which widen out with each generation. This schema forms a triangle whose base expands with each new generation. Thus in the first row, representing the zero-th period (or apex of the triangle), write the number of starters of the diffusing process. In the second row, representing the first period of diffusing, write the increment or number of converts made by the starters during the first period. In the third row, representing the second period (or "generation" or "remove") of diffusing, write the two increments who were converted by the starters or zero generation persons plus those converted by the first generation increment which was written in the second row. In the fourth row, write similarly the sum of the increments produced by all the increments in the preceding rows or generations. Continue this process of unrolling the schema to n-generations. Thus, however regular or irregular the rate of converting and the consequent increments may be, the schema provides a detailed record. With suitable subscripts, as in combinatorial algebra or as in matrices, each increment can be tagged to show its generation and all its ancestry. If the increments are analyzable into regular patterns (as when, for example, each generation doubles itself), combinatorial formulas in this increment schema can give the sum of the series, the sum in any one generation, the descendants of any one ancestor, the ancestors of any descendant, etc. If a complete record of ancestry and descendants is desired for each individual in the population and not simply for each increment of population, then the interperson matrix must be used as shown in Figure 3 B, D, and F.

3. The matrix as an analytic tool.

Among the finite difference technics another powerful tool for exact analysis of diffusing or of any interacting is the matrix. A matrix tabulates items in rows and columns, making one orderly array for each variable. See Figure 3 for examples. Each cell contains an entry which, whether a number or a quality, is a logical product of its row and column (and sagittal array if in a "solid" matrix with three axes). The cell entry is jointly characterized by every array or variable in which it occurs. Thus in Figure 3, the population is listed *as actors,* each person heading one row and is again listed in the same order *as actees,* each person heading one column. The cell entry states or measures the interrelation of the row

actor and the column actee thus specifying which persons as diffusers contacted which persons as diffusees.

The 2-matrix with two axes as shown on a "page" in Figure 3 may be expanded to an n-matrix with n axes to deal with n variables *simultaneously* in any social situation studied. Thus the 2 matrix cross-classifying actors and their actees are shown one "page" as of one date, and may be expanded along the time axis by superposing another "page" for each added date. This makes a "book" or 3-matrix cross-classifying the two dimensions of group structure or interactivity with the time variable. The increment schema above is a "slice" through such a "book" as it is a 2-matrix cross-classifying people with generations of time. Thus all dynamic phenomena of groups can be ordered for exactly specified and rigorous study of social processes, diffusing, change, ages, sequences, dates, tenses, or any other temporal aspect of activity.

An alternative to expanding a matrix along another perpendicular axis is to expand it with further "sections" along the existing axes. Thus each successive period of time would add its matrix section (i.e., sets of rows and columns) as in Figure 2. When the successive sections represent successive generations or removes, the matrix spells out the descendants and ancestors of everyone in a fully specified increment schema.

With one added axis it can cope with any number of diverse kinds of behavior by providing a "shelf" of "books" for each kind of behavior. With another added axis it can cope with spatial series, recordable in "bookcases" of "shelves." By adding an axis for every variable studied which cross-classifies all the other variables the detailed structure and functioning of group activity can be specified and treated mathematically. In short, the matrix orders the phenomena of groups preparatory to any further analyses or syntheses the researcher may desire. Thus the matrix provides a place to record comprehensively yet precisely all possible human interrelations.

These and many more uses of the socio-matrix for law-discovering and law-generating studies of strictly social or *inter*human phenomena are only beginning to be appreciated by sociologists.[1]

[1] See the bibliography attached and fuller listing in Reference 7 for the growing use of sociomatrices.

III. Two Experimental Tests of Diffusion Models

The testing of a finite difference model in this diffusion theory may be illustrated by two experiments.[2] These were designed to test a logistic or continuous curve model and a geometric series model so that applying Winthrop's "Case 11" model (which was formulated independently of these data) will be a more rigorous test of such a model. For one of the social conditions (the hearers-per-teller ratio) was not known in advance and had to be guessed in order to apply the mathematical assumptions of the model. Therefore a very close fit is not to be expected until more definitive tests can be made. However, these tests illustrate the methods of testing the theory and the high degree of fit resulting from even this imperfect testing.

The model applied here is "Case 11" among the eighteen basic models which vary periodicity, repetition, and group structure as listed in Table 1. This model is deduced from the three assumptions of rectangular periodicity, no repetitions, and completely iadic structure. Alternatively stated, the model deals with a social situation where the diffusing is at a steady rate, new, and equally possible for all the population. Note the implications of each of these three mathematical assumptions or social preconditions.

Rectangular periodicity here means that everyone, on the average, retells the message steadily from period to period (or from remove to remove, if ordinary time units are studied). The variance of the potency, or mean hearers-per-teller ratio, will be small over the set of equal and consecutive periods studied. Obviously this is a statistical approximation in which the question is: Are the actual deviations from steady potency large enough to result in a poor fit and lower the prediction?

Complete iadicity, or interrelatedness, here means that everyone is acquainted with everyone else at least well enough to have equal opportunity to retell the message. The group structure is "homogeneous" with respect to the probability of retelling. The probability of anyone telling anyone is equal for all. Of course, as the group gets larger its members will not all be acquainted. But we believe, from preliminary experiments not yet explicitly checked, that this condition of equal opportunity to interact is approximated in a large population if each person's circles of acquaintances

[2] These were two of a score of "pretests" made during the first or exploratory year of Project Revere. This project, conducted by the Washington Public Opinion Laboratory on contract with the Human Resources Research Institute of the Air Force studies how to maximize the social diffusion of a message started by leaflets dropped from planes.

for various purposes overlap with other person's circles in a sufficiently random manner as yet unspecified. This will tend to make the whole community in effect interconnected even though each person is acquainted with only a few and variable number of other persons. Iadicity means that there are no physical or cultural barriers which are correlated to the diffusing and therefore nothing will operate to lessen the diffusing and make opportunities to interact unequal in effect. The population may be very heterogeneous in a thousand respects provided each respect is uncorrelated with the diffusing activity. In this sense the population should be homogeneous-relative-to-the-diffusing or show an equal chance for everyone to interact with a few people around him.

The third condition of allowing no repetitions means that only first hearers, or newly contacted persons, are considered. All repeated contacts of a person already converted, i.e., one who is already a knower of the message, are neglected.

These three pre-conditions of *steady, new* and *equal* interacting are substantially the conditions giving rise to a logistic S-shaped continuous growth curve of which Case 11 is a finite difference form.[1]

Pretest Q, was a diffusion experiment in a Y.M.C.A. summer camp in July 1952.[2] A novel behavior was spread to 37 out of 42 boys during the two hour rest period and its growth recorded in the number of converts made every fifteen minutes. Three "starter" boys (a leader, an isolate, and a "middler" on a sociometric test given earlier) were given a large yellow pin with the name of the camp and a question mark in black on it. Each was told:

> "Here is a special pin. It is important that you wear it today. We have a few more of them, but not enough for all the campers. Those campers who find out about this and come to the 'Old Lodge' will also get a pin, as long as our supply lasts. Remember, it is important that you wear it today, and remember that we don't have very many pins."

As each boy went back into the camp, others saw the pin, asked about it and came to get one like it, diffusing the pin-wearing behavior through the whole camp. Note that the distance factor between interactors was negligible here; the stimulus and other conditions were kept fairly constant;

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[1] The detailed mathematical derivations, discussion and computation of these models here may be obtained on application from the Washington Public Opinion Laboratory.

[2] The experimental design and fuller report on Pretest Q by Richard J. Hill and Otto N. Larson and on Pretest M below by Arch Cooper may be obtained on request.

the group was small and all knew each other; the time was short with no cyclic or other patterning from competing activities; and the act of acquiring the pin was unrepeatable. According to the formula* for Case 11 the expected and observed number of converts in each quarter hour as shown in Table 1 fits fairly well, though not up to our standard of a closeness of fit correlation coefficient over .9 on uncumulated data. The closeness correlation was .85 (which was acceptable at the 5% confidence level). We conclude that this model shows promise under these conditions and should be tested further with better data. (Two further sets of campers are being tested.)

TABLE 2

GROWTH OF THE PIN-REQUESTING BEHAVIOR AT A CAMP (A TEST OF A DIFFUSION MODEL)

Clock time interval t	Expected converts e	Observed converts o
12:45	3.00	3
12:46 to 1:00	2.76	0
1:01 to 1:15	4.84	6
1:16 to 1:30	7.74	9
1:31 to 1:45	9.17	8
1:46 to 2:00	7.15	5
2:01 to 2:15	2.08	3
2:16 to 2:30	0.37	2
2:31 to 2:45	—	1
Total	37.11	37

r_{eo} = .85 on uncumulated data showing fair fit of the Case 11 model expectation to the observed data.

A second experiment provided a test of a variant of Case 11. Pretest M, which was called Chain Tags, was repeated in each of four matched

* The formula for Case 11 is: $_{T}P = {}^{T-1}P\ A/_{PT}\ (1 - {}^{T-1}P/P_D)$
where $_{T}P$ = the increment in converts during period $_{T}1$
^{T-1}P = the converts up to the end of the previous period
$A/_{PT}$ = the potency rate or acts-per-person-per period the diffusing activity index (here guessed at 1.0 for lack of advance data) later found to be .92
P_D = the total diffusable population (here 37 boys)

villages of about a thousand population each. The chain letter idea was modified to get people to pass on a printed message from person to person. Each of the ten representative starters in each community was handed a cellophane wrapped packet of return addressed postcards all alike. Each packet broke down into a "tracer" postcard to be filled out and mailed in and a subpacket to be given to someone else. Each packet contained a series of ten subpackets allowing it to go to a chain of ten persons at most through ten removes, each tagged by its tracer postcard. Each card recorded the name and address of the respondent and his preceding and succeeding "links" with the time, place, etc. of getting the packet. The motivations to cooperate were four, one in each town, namely "to help science" in the first town, "to help Civil Defense" in the second town, "to help a modern Paul Revere in an emergency" (i.e., to test whether a vital message could be spread in this person-to-person way) in the third town, and "to earn a dollar" (a payment for responding) in the fourth town. By using remove units of time and by allowing three weeks for the diffusing to finish (before the deadline printed on the cards) the effect of daily and other cyclic activity was eliminated. Distance may have been a factor though we believe it correlated very little with the diffusing (the address data was not adequate to compute the r). The stimulus, motivation, and other conditions seemed fairly constant within each town. The upper limits of the starting population, the diffusable final population, the activity rate of potency, and the overall period were all experimentally controlled in this Chain Tags test.

The formula* used here was a variant of Case 11 developed by Winthrop so as to match the social condition that only the last remove persons (not the cumulated total of recipients) were able to pass on the message to the next remove persons. The agreement for the four towns combined between the model's expectation and the observed data is shown in Table 3.

The closeness of fit correlation for the uncumulated data was .93 with a goodness of fit from sampling acceptable at the 1% confidence level.[1] The

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* The formula therefor is: $_{T}P = {}_{T\text{-}1}P\ A/_{PT}\ (1 - {}^{T\text{-}1}P/P_D)$
where $_{T\text{-}1}P$ = the increment in converts in the $_{T\text{-}1}1$ period
and $A/_{PT}$ = 1 since each receiver gets only one subpacket to pass on.

[1] The closeness of fit correlation was .999 in the cumulated data. This is a spurious correlation since cumulating compels some correlation even of chance

TABLE 3

GROWTH OF THE MESSAGE-RECEIVING BEHAVIOR IN FOUR TOWNS

Order of the remove	Expected receivers	Observed receivers
zero-th	40.00	40
1st	28.00	28
2nd	23.00	23
3rd	21.19	23
4th	24.97	20
5th	18.88	19
6th	19.38	16
7th	14.56	10
8th	7.12	7
9th	5.36	7
10th	6.97	8
Total	209.	201

$r_{eo} = .93$

degree of agreement between the hypothesis specified by the model and the observations is well over our standard of a closeness of fit correlation exceeding .9 and the 5% confidence level. We conclude therefore that this model fitted the data well here, and under like conditions (of random and steady chain interacting) can be expected to predict diffusing well in new situations.

It must be remembered that the model called Case 11 here states one hypothesis among the many score of hypotheses that comprise our diffusion theory. It deals with the case of steady activity under equal opportunity.[2] It therefore tests only a small part of the total dimensional theory of diffusion which requires much further testing.

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related items. It is noted here, however, partly for comparison with other curve fits reported in cumulative data in the sociological literature. It is also partly in order to emphasize the principle that reporting correlations in uncumulated data is the more exacting test and the only proper test for closeness of fit correlations. Thus the r from cumulated data in Pretest Q Table 2 is .9994 while the r from uncumulated data was only .85.

[2] These conditions are more operationally specified statistically by a vanishing variance of the activity rate over the time periods and non-vanishing cell entries in the matrix of group structure. The dimensional formula for this case $[T^{-2}\ P^{2}\ A^{1}]$ shows that it involves only the time factor in celerated form $[T^{-2}]$, the population factor in group form $[P^{2}]$, and a simple activity [A] from the set of factors in Eq. 1.

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